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ART. XXXV.—OBSERVATIONS ON ASARUM CANADENSE, AND ASARUM EUROPŒUM. By WILLIAM PROCTER, Jr.

THE Asarum Canadense has been the subject of several writers in this country, whose investigations have gone far to elucidate its chemical history. Dr. Bigelow, in his Medical Botany, has given a short account of its chemical constituents, among which he ascertained the presence of light-colored, pungent and fragrant essential oil, a red bitter resinous matter, starch, and gum. After Dr. Bigelow, no experimenter occupied himself with this plant, so far as I am acquainted, until the late Richard Rushton, who, in his inaugural essay* on this subject, before the Philadelphia College of Pharmacy, has extended our knowledge of its chemical constituents. He ascertained the presence of fatty matter, chlorophylle, salts of lime and potassa, iron and lignin; besides giving a more accurate account of its first mentioned constituents.

The following quotation is from the paper of Rushton, under the head of Affinities. "But the congener with which it is most frequently compared, is the European species, Asarum Europœum. Guibourt, in his Hist. Abrégée des Droges Simples, third edition, states 'that the root sent to him, from Philadelphia, by Mr. Durand, did not seem to him

* See Vol. x, Page 181, of this Journal.

to differ from the Asarum Europœum.' From this resemblance, several botanists have been induced to suppose that they were only varieties of the same, which, however, is not the case. If there be, upon fair comparative trial, the *slight difference in medical properties that has been supposed*, may it not be attributed rather to the degree or amount, of the active proximate principle in one, that is not found in the other? Thus the essential oil would seem to be the most energetic element of both, and the greater emetic power of the Asaret of Europe, may depend on its presence in larger proportions."

These remarks lead to conclusions which are certainly erroneous, if we may credit the authors who have written upon the subject. Dr. Wood, U. S. Dispensatory, says, "The root and leaves of Asarabacca, either fresh or carefully dried, are powerfully emetic and cathartic, and were formerly used in Europe with a view to these effects." "But as an emetic they have been entirely superseded by ipecacuanha, and are now used chiefly, if not exclusively, as an errhine. The powdered root snuffed up the nostrils, in the quantity of one or two grains, produces much irritation, &c." Professor Pereira, in his Materia Medica, says "Every part of the plant possesses acrid properties. Applied to the mucous membrane of the nose, it produces violent sneezing, etc." "Swallowed, it causes vomiting, purging, and griping pains."

On the contrary, the Asarum Canadense, except a slight nauseating tendency in large doses, possesses neither emetic or cathartic properties, but is an aromatic stimulant, with diaphoretic powers. It is said formerly to have been used extensively, instead of ginger, by the country people, of some parts of New England, for making ginger beer. I have been informed by those who have used it medicinally, that they have never known it to act as an emetic, or cathartic, and that it is altogether a mild remedy. So striking a difference in the medicinal power of the two plants, renders the supposition of their different chemical character perfectly natural.

The object, therefore, of this paper is to demonstrate the difference which really exists in their chemical constitution.

It will be proper to give an outline of the results of the analysis by Lassainge and Fenoulle, (Journ de Pharm, vi. 565) and Graeger (Annal der Pharm. 1830,) which are as follows:

Graeger.		*Lassainge and Fenoulle.*
The Root.	*The Herb.*	
Volatile oil,	Asarin,	1 A solid volatile oil, (asarin)
Asarum Camphor,	Tannin,	2 A very acrid fixed oil,
Asarite,	Extractive,	3 A yellow matter analogous to Cytisite,* in which the properties of the root reside,
Asarin,	Chlorophylle,	4 Starch,
Tannin,	Albumen,	5 Mucous,
Extractive,	Citric acid, &c.	6 Ulmin,
Resin,		7 Citric acid,
Starch,		8 Bicitrate and malate of lime, &c.
Gluten, &c.		

The yellow matter of Lassainge and Fenoulle, appears to be identical with the Asarin of Graeger. The solid volatile oil of the former, which they call *asarin*, is a mixture of the *Asarum camphor*, *asarite*, and volatile oil, of the latter.

† When asarum root is distilled (according to Graeger) it furnishes a milky liquid, having an aromatic smell and acrid taste. On the surface of the liquid, yellow drops may be observed swimming, which are gradually converted into needle-shaped crystals, constituting the Asarite. When separated from the liquid by a filter, they were dissolved in alcohol and precipitated from that solution by water. They now constituted a brilliant white mass, floating in the liquid, while a yellow milky fluid was deposited, which was composed of

*Substance Obtained from the Cytissus laburnum, by Chevallier.

†Thompson's organic Chemistry.

volatile oil and asarum camphor; the latter was obtained by evaporating the oil.

Asarite is in small silky needles, sp. grav. 0.95 at 158° Fahr. It melts into an oily liquid, and a further heat volatilizes it in white vapor, which is very irritating.

Asarum camphor, is distinguished from *asarite* by its vapor being much less irritating, and by being precipitated from its alcoholic solution by water, in cubes or six-sided prisms. It melts by heat, and boils at 536°.

Oil of Asarum. This oil has a yellow color, glutinous consistence, is lighter than water, has a sharp burning taste, and a smell of valerian.

By reference to Graeger's analysis, it will be perceived that neither volatile oil, asarite, or asarum camphor exists in the leaves of asarabacca, and as they are less active than the root, it will be proper to attribute the superior activity of the latter to the presence of those ingredients.

The *asarin* of Graeger, appears to be an acrid resinous matter.

Having now given an outline of what is known respecting the chemical constituents of the European asarum, it will be proper to detail a few experiments, which have been principally made, to ascertain what analogy there exists between their volatile ingredients.

Four ounces of the root of the Asarum Canadense, recently dried, was finely bruised, and introduced with eight times its weight of water, into a glass retort, where it was allowed to macerate for twenty four hours. Heat was then applied, and continued until three-eighths of the liquid had distilled. The product consisted of a slightly milky fluid, having numerous large globules of volatile oils floating on its surface. The receiver was allowed to remain with these fluids in it, undisturbed, for forty eight hours, the air having free access; but not the slightest evidence was apparent of any disposition to crystallize, nor was there a trace of crystalline matter in the neck of the retort.

The oil was now separated; it amounted to *five* per cent. of the root employed, and had a straw yellow color.

Again; ten ounces of the dried root, was distilled with seven times its weight of water, and four fluid ounces of alcohol, after maceration for five days. The result of the operation, was a very milky fluid, on which floated a considerable quantity of essential oil, of a lighter color than that before obtained. The milky fluid gradually became transparent, a small quantity of oil separating on its surface, but on the addition of water it again assumed a milky appearance, doubtless owing to the separation of a quantity of volatile oil held in solution through the intervention of the alcohol.

A portion of the distilled fluid and accompanying oil, was exposed in the receiver for two weeks, to the influence of the atmosphere, without the slightest evidence of its becoming crystalline, or in any way changing its character.

Another portion of the distilled water and oil was treated by a current of oxygen gas, and afterwards exposed to an atmosphere of oxygen, but no change whatever ensued, hence it may be concluded that the Asarum Canadense, does not contain either asarite or asarum camphor, nor substances analogous to them.

When an alcoholic tincture of the root is evaporated, a greenish yellow oily matter, and a reddish matter are obtained. The first appears to be a mixture of volatile oil, and an acrid resinous substance, which differs in taste from the oil, in being acrid and bitter, without being aromatic.

When an ethereal tincture of the root is suffered to evaporate spontaneously, there results greenish globules of oily matter floating on the water, which remained after the evaporation of the pure ether. This matter had an acrid disagreeable taste,—and when treated with alcohol nearly all of it was dissolved. On evaporating the alcoholic solution, a semi-fluid substance resulted, which appeared to be a mixture of volatile oil, acrid resin, and probably a little fixed oil. It had a very acrid, burning taste, and when heated, copious

white vapors of volatile oil were evolved, and the resinous matter remained.

In many respects there appears to be an analogy, both medically, and chemically, between this asarum, and ginger and cardamom. They all three possess aromatic, stimulant, and carminative properties; and these properties in all of them, appear to depend on their volatile oil.

The leaves of the Asarum Europœum, according to Graeger's analysis, do not contain any volatile oil, which appears to be the case in regard to the American species; the dried leaves of which, have none of the peculiar aromatic, pungent taste of the root. It is most probable that the emetic and cathartic properties of the former, are mostly due to the acrid matter, called *asarin* by Graeger, and a *yellow matter, etc.*, by Lassainge and Fenoulle. The acrid matter found in the Asarum Canadense, does not appear to possess the activity of that contained in the asarabacca. What part the *asarite*, and *asarum camphor* plry in the medical character of European Asarum is unknown, as no mention is made in any of Graeger's results, which I have been able to meet with.

ART. XXXVI.—PHARMACEUTICAL NOTICES. No. XX.

By William Procter, Jr.

Vallet's Protocarbonate of Lime.

Many have complained of the difficulty attending the successful accomplishment of the process for making this preparation. The extent to which it is now used in this medical community, and perhaps in others, makes a thorough knowledge of the details of manipulation in the process for its manufacture, very desirable. The greatest difficulty which has heretofore attended the process, is the evaporation of the water, from the mixture of hydrated oroto-carbonate of iron and honey. Too high a temperature causes the decomposition of the carbonate, which is only prevented under ordinary circumstances by the presence of the saccharine matter. If, on the contrary, too little heat is used, the evaporation is so slow, as to make the process inconveniently long; not to speak of the protracted exposure of the salt to the action of the atmosphere.

By suspending a thermometer in the mixture during the process, it was found that the evaporation would proceed successfully at the temperature of 150° Fahr.; but much beyond that point, the evolution of carbonic acid gas commenced, and was rapid at the temperature of boiling water; and hence, that by keeping the mixture steadily at 150 degrees, the end desired was attained in the shortest time, compatible with the excellence of the product.

As some time has elapsed since the publication* of the papers on this subject, it is thought that a re-statement of the formula will not be out of place at this time.

Take of Proto-sulphate of Iron, (crystallized,) ℥xvj.
Carbonate of Soda, (crystallized,) ℥xix.
Clarified Honey,
Boiling water, of each a sufficient quantity.

* See Vol. x, pages 244 and 272, of this Journal.

Dissolve the Sulphate of Iron in four pints of the water, and add three ounces of honey to the solution. Dissolve the Carbonate of Soda in the same quantity of water, with a similar quantity of honey, subsequently added. Mix the solutions thoroughly in a bottle just capable of holding the mixture, stop it closely, and allow it to remain 24 hours, until the precipitate subsides. Draw off the supernatant fluid with a syphon, and again fill the vessel with honeyed water, in the same proportion as before, mix thoroughly, and again draw off. Repeat this operation a third time, that all the sulphate of soda may be washed away,—then pour the precipitate upon a flannel cloth, suffer the liquid to drain off as much as possible, and subject what remains to *gradual* pressure, until as much water is removed as possible. Then place it in a suitable evaporating dish, add nine ounces of clarified honey, and mix them intimately. Having put the evaporating vessel on a water bath, the temperature of which should be so regulated as to keep the mixture of honey and proto-carbonate at the temperature of 150 degrees, it should be stirred occasionally at first and frequently toward the last of the evaporation, until it acquires a pilular consistence. There is no difficulty in regulating the temperature of the water bath. By placing a lamp under the vessel which serves as the water bath, its flame may be so regulated as to keep the mixture at the constant temperature of 150 degrees, by placing a thermometer in it, until that degree is attained, and then lowering the flame, if necessary, until the thermometer remains stationary.

This preparation when made in winter, is generally too soft for summer use in the form of pills, without the addition of some dry substance to give it a firmer consistence. My friend Elias Durand, of this city, has proposed the substitution of sugar, for a portion of the honey, which he assures me gives increased consistence to the mass. About 4½ ounces of sugar should be added in place of the same quantity of honey, in the above formula.

By following the above directions, a product will be ob-

tained containing the full equivalent of carbonic acid, and of course proportionably soluble in acids.

Fermentation in Syrups.

The almost inevitable state of fermentation into which many of our syrups enter, during the warmest season of the year, is but too well known, and often puts the pharmaceutist to considerable inconvenience. This more particularly relates to those syrups which contain much vegetable matter in solution, independent of the sugar, which forms the basis of the preparations.

Elias Durand some time ago communicated to me the fact, that Hoffman's anodyne, through the agency of the *oil of wine* which it contains, possessed the remarkable property of completely arresting fermentation in syrups, and preventing it before it has commenced. He finds that syrup of gum arabic, which is very liable to ferment and change, may be kept without difficulty, by the addition of 1.3 per cent. of Hoffman's anodyne, or about 1 part to 75 of syrup. Whatever part the oil of wine may act, in preventing fermentation, the same power is possessed by sulphuric and nitric ethers, and alcohol. A vegetable infusion containing about 10 per cent. of solid matter in solution, was kept for many months, without apparently the slightest change, by the presence of a small quantity of sulphuric ether.

A pectoral syrup, containing an unusually large amount of vegetable matter in solution, such as gum, extractive, etc., which was found to ferment even in moderately warm weather, was wholly prevented from so doing, even during the warmest days of the past summer, by the addition of six per cent. of spirit of nitric ether.

The superior advantage, however, of the Hoffman's anodyne, is due to the smallness of the proportion requisite, and to the slight volatility of the oil of wine, which consequently will continue its influence longer than the ethers.

An additional evidence may be adduced in the case of *brown mixture*, which, when made without spirit of nitric

ether soon spoils, and undergoes the acetous fermentation, while, if that ethereal spirit is added, it keeps for a considerable time.

Coxe's Hive Syrup.

A formula and process for making this preparation, was published in the 11th volume of this Journal, (page 198,) which was believed at the time of its publication to have arrived at complete success, so far as related to obtaining an active remedy, which would keep during warm weather, without undergoing fermentation.

The process alluded to, consists in treating the senega and squill with diluted alcohol, in a displacement apparatus, until twice the quantity of fluid is obtained that is required to make the preparation; then raising the temperature to the boiling point, to coagulate the albumen, then evaporating to one-half, and straining carefully, in order that *all* the coagulated albumen may be removed. Lastly, adding two pounds, avoirdupois, of loaf sugar to each pint of the clear infusion. This process, with some modifications, is the one recommended in the Report of the Committee of Revision on the U. S. Pharmacopœia. Those that have employed this formula, have been much pleased with it for the following reasons:—*Firstly*, The product is decidedly more active than that of the Pharmacopœia of 1830. *Secondly*, It is much less liable to ferment. *Thirdly*, Being made with sugar instead of honey, it is a more handsome preparation.

Coxe's Hive Syrup, made as above, was found to keep very well during the past summer, except on a few of the warmest days, when it evinced a slight disposition toward fermentation, at a temperature of from 80 to 90° Fahr., but not more than simple syrup, kept under the same circumstances. To totally prevent this, it is proposed to add two fluid drachms of Hoffman's anodyne to each pint of the syrup, for summer use; which, without at all injuring its qualities as a remedy, will effectually preserve it from fermentation.

A process, (said to be that originally employed by Dr.

Coxe,) has been lately used by several apothecaries,—which is the following. Proceed in the way above stated, to prepare the infusion or tincture of seneka and squill, then evaporate to the consistence of a syrup, and mix it with as much honey as equals in measure the quantity of the preparation required. Lastly, boil gently, to thoroughly mix them, and add the tartar emetic. When thus made, Coxe's Hive Syrup, it is said, never ferments.

The objections to its being made by this formula, are, that the long evaporation required to reduce five or six pints of fluid down to three or four ounces, will tend to injure the activity of the remedy, even when carefully executed; but careless manipulation will certainly produce this effect; and that honey varies so much in quality and density as would give an irregular consistence to the preparation.

A specimen of syrup made very carefully by this formula, and one made with sugar by the foregoing, without the addition of the Hoffman's anodyne, were kept in similar vessels, equally exposed to the action of the atmosphere for six weeks, and occasionally agitated.

The latter showed evident signs of fermentation at the end of that period, while the former was perfectly unaltered. That, prepared with sugar, however, remained perfectly unchanged, during the same time, by the presence of the quantity of Hoffman's anodyne above indicated.

Syrups.

The employment of the *Saccharometer*, or instrument for measuring the density of syrups, is by no means general. Those who are in the habit of employing this useful instrument in syrup-making, can appreciate the advantages which result from its use, both as regards facility of manipulation and uniformity of consistence in the preparation. The instrument is too well known to need a description, but it may be well to mention, that as a general rule syrups should be concentrated till they mark 30 degrees on the scale, while boil-

ing, which is equivalent to 35 degrees, when cold. In summer the concentration should be carried farther, on account of the liability to fermentation.

It should be remembered, however, that when there is a large quantity of extractive, or other matter, independent of the sugar, an allowance must be made; as, for instance, syrup of senega will mark 37 degrees when cold.

Arrow Root.

The best arrow root received in this country is from Bermuda—from which place it is frequently brought in wooden boxes and casks. The fecula is thus exposed to acquire the odor of the ship, which, together with dampness, gives much of it a musty taste and odor, which renders it unsaleable.

Having had some arrow root thus affected, which otherwise was of superior quality, it occurred that by washing with pure water, and drying it, the defect could be removed. On carrying this suggestion into practice, it was found to answer admirably, and the fecula which resulted was equal in every respect to the best article of our market, which may have escaped the influence of the vessel.

All that is necessary to bring about the proposed result is to provide a circular earthen vessel, of three times the capacity of the arrow root to be treated, and fill it two-thirds with pure water. Having given to this fluid a rotatory motion by stirring, gradually add the defective arrow root, constantly stirring until the whole of it is suspended in the water, in which state it should be kept for five or ten minutes. After the fecula has subsided, the supernatant fluid should be decanted, and the operation repeated. Owing to the manner in which the arrow root becomes compacted, in subsiding from water, it is best to remove it from the washing vessel, and afterwards add it to a fresh portion of water as before.

Two such operations will entirely remove the mustiness. All that is necessary in drying it, is to place the damp fecula on frames of muslin, covered with paper, in a warm place,

and in two or three days it is perfectly dry, and possessed of all the characteristics of the pure Bermuda arrow root.

As the grains of fecula are insoluble in cold water, and the mustiness is on their exterior, we can readily conceive how washing it should remove the defect, without injury to the fecula. Since trying this process, a friend, to whom it was communicated, has been equally successful in its application.

Hydrochlorate of Ammonia. Sal Ammoniac.

The difficulty of reducing this salt to powder, in the ordinary way, with pestle and mortar, is too well known to require comment. A much easier and more effectual way is the following, which though not by any means offered as original, may yet be new to many of our pharmaceutists.

Make a saturated solution in boiling water, of the salt, and allow it to cool gradually, stirring constantly, in order, that as the hydrochlorate separates by crystallization, it may be granulated. When cold, throw the whole on a glass funnel, the neck of which is partially closed by a piece of cotton, and allow it to drain, then throw it on bibulous paper and dry it. The salt can now readily be reduced to fine powder.

Black Ink.

Although Ink is not a pharmaceutical preparation, yet it is a compound that the apothecary is constantly called upon to make, either for his own use or for other's, and it has been thought that the following formula would not be out of place here.

Take of Galls, finely bruised,	℥8
Inferior Gum Arabic,	℥4
Sulphate of Iron *in powder*,	℥4
Aqua Fortis,	℥i
Water,	a gallon.

Macerate the galls in a portion of the water, for three hours, then put them into a displacement apparatus, and treat them

with water until exhausted, or until seven pints of infusion is obtained. Dissolve the gum in half a pint of water, and add it to the infusion of galls. Lastly, add the sulphate of iron to the aqua fortis gradually, and afterwards two ounces of water; heat the mixture till red fumes cease to be evolved, then mix the solution with the infusion of galls, agitate the mixture, and the *ink is made.*

ART. XXXVII.—NOTE ON VANILLA.

VANILLA is an article of commerce, more sought for by the confectioner than the apothecary, as it is employed to communicate flavor to sugary preparations, and such as pertain to diet, rather than as an ingredient of medicinal compounds. By the latter, however, it is usually dealt in, and from him the confectioner obtains it. Although not possessed of such decided medicinal properties, as to give to it a prominent place in the list of Materia Medica, where it has of late been located, still it is of sufficient importance to attract attention. The interest attached to it is also greatly enhanced by the favorable estimation in which it is held by the public, a circumstance, which at times has created a demand for a greater supply.* In the following communication we propose to detail the facts connected with its history, as well as notice the application to which it has been put in a medicinal point of view.

Originally by Linnæus, the fruit of the plant which is the product used, was attributed to the Genus Epidendrum ; by Swartz it was separated and called *Vanilla aromatica.* It belongs to the natural family of ORCHIDEÆ, and to the Linnaæn clasification, *Gynandria. Diandria.*

It is a woody, sarmentose plant, elevating itself to some

* We have been informed by Mr. Ritter, our collaborator, that the drug has recently commanded three times the usual price of the market.

height, by seizing on and attaching itself to the trunks of contiguous trees, by means of radical fibres, which insert themselves into the bark. Its leaves are alternate, sessile, thick, fleshy, a little coriacious, smooth, shining, slightly undulated upon the borders. The flowers are large, forming clusters of five or six, purple, odoriferous. The five superior divisions of the calyx, are lanceolate, a little undulated, the lip is oboval, grooved and hollow, a little sinuous on the margin. The *fruit* is from five to eight inches long, and two to four lines in diameter, straight, obscurely triangular, with a suture between the valves, somewhat pointed at the end of attachment, obtuse at the opposite ; color reddish brown or black, shining; wrinkled longitudinally. The surface is somewhat viscid. Internally, the fruit is filled with an innumerable quantity of black seeds, dull, and surrounded by a pulp of the same color, small in quantity and intermingled with medullary matter of a red color. This fruit improperly goes by the name of the *vanilla bean*, an appellation derived from its appearance Vanilla is stated to come from *vaina*, or sheath, in Spanish, of which the diminutive is *Vainilla*. The Spaniards of Guaiana call it *Banilla*, and the Mexican name is *Tilxochitl*.

The Vanilla plant is a native of South America, and some of the West India Islands. It grows particularly in Peru, Brazil, Guaiana, and is also found in Mexico. In some colonial positions it is cultivated, as at Cayenne, St. Domingo and the Isle of France. Like all the Orchideæ, however, it is difficult to cultivate, and does not afford fruit of much value until seven years of age. The difficulty of cultivation must arise from its peculiar habit which is that of a parasite; although having its root in the ground, it soon becomes independent of this attachment, and when cut from it, will sustain itself by the radicles penetrating the bark of the trees which support it. It, likewise, prefers sombre, shady situations.

Vanilla is collected before it attains perfect maturity,—this is to avoid the separation of the valves and the escape of a thick fluid, which forms in it, and constitutes what is known

and used in Peru as Balsam of Vanilla, an article not known in Europe or this country. The drying operation is accomplished in the shade, and each fruit is touched with oil, to keep it supple and to keep off the insects. When fully prepared, bundles are formed, composed of from five to one hundred pieces. The odor is exceedingly sweet and agreeable in this state; in order to retain its freshness and value, it is preserved in close tin or leaden canisters. Some other modes of preparation are mentioned; thus, the fruit is dipped in boiling water, drained by hanging it up, and dried by exposure to a current of air for 15 days. It is then wrapped in oiled paper, by which its qualities are preserved. The Mexicans are said to prepare Vanilla by a kind of fermentation, which they arrest in time. Perhaps it is to this fermentative action that it owes its flavor, as the fruit when green possesses none of it, but acquires it subsequently.

According to Guibourt, there are three varieties of this drug, which "appear to be attributable to three varieties of the same plant, for to the present, botanists recognise but one species."

The first sort, which is most esteemed, corresponding with what the Spaniards call *Leg* or *Lec*, legitimate; it is from six to eight inches long, three or four lines broad; wrinkled and grooved lengthwise, narrow at the extremities and curved at the lower end; it is a little soft and viscid, of a deep reddish brown color, and possessed of a strong and sweet odor, similar to that of Balsam of Peru.

When kept in a dry place, and in a vessel not closely covered, this article is not long in becoming covered with brilliant needle-shaped crystals, those of Benzoic acid. It is then called *frosted vanilla.*

The second sort, is the *Simarona*, or bastard Vanilla. This has all the physical characters of the preceding, and it is evident that it is from the same species; it, however, is smaller, of a less deep brown color, dryer, less aromatic, and not frosted.*

*Hist. Abregée des Drogues Simples.

The last kind is named by the French *Vanillon*, by the Spaniards it is called *pompona* or *bova*, from its swollen appearance. It is always from five to seven inches long, but from six to nine lines broad. It is very brown, soft, viscid almost always open, and appears to have passed the point of maturity; it is endowed with a strong odor, but less agreeable than the first, and little balsamic; often, also, it has the taste of fermentation; it is bought for a lower price. This kind, must certainly be produced by a different species of the plant.*

The analysis made by Bucholz, showed that Vanilla contains,

1. A fatty oil.
2. Soft Resin.
3. An Extract, a little bitter.
4. Peculiar Extractive.
5. Apothema.
6. Sugar.
7. Amyloid substance.
8. Benzoic Acid.
9. Fibre.

The fatty oil has a rancid taste and a disagreeable odor, the resin is soft and gives off when heated the feeble smell of Vanilla. The peculiar extractive resembles tannin. It precipitates the salts of iron green, renders tartar emetic cloudy, but does not precipitate gelatine. As to the benzoic acid, the crystals regarded as such are not acid.†

Bucholz says that Vanilla does not give off a volatile oil by distillation. This favors the idea of the generation of the odoriferous principle by fermentation.

In the mode of affecting the economy, the substance under

* There are a number of species noticed by authors, as V. *claviculata*, V. *angustifolia*, and V. *planifolia*. SCHIEDE, (*Schlechteudas*,) Linnœa, Oct. 1829, s. 573, mentions three Mexican species, V. *sativa*, V. *sylvestris*, and V. *Pompona*.—See PEREIRA'S MAT. MED. Mr. Salisbury states the V. *planifolia* was discovered in St. Domingo by Father Plumier, and introduced into the hot-houses of England.—Loudon, ENCYC. OF PLANTS.

† Soubeiran, Nouveau Traite de Pharmacie.

consideration is stomachic and cordial; it exerts a decided tonic action, facilitating digestion and invigorating nervous influence. In large dose it has the reputation of exerting aphrodisiacal power in a marked degree. Of late, it has been little used, except as an addition to articles of diet, which may be more readily digested, in consequence of its stimulating property. The following modes of employment have been taken from Soubeiran's Treatise.

Powder of Vanilla.

℞ Vanilla, 1 part.
Sugar, 4 "

Triturate and pass through a hair seive.

To be used for culinary purposes, or medicinal preparations.

Tincture of Vanilla.

℞ Vanilla, 1 part.
Alcohol at 33°, 8 "

Macerate and filter.

Alcoholate of Vanilla.

℞ Vanilla, 1 part.
Carbonate of potassa, ¼ "
Rectified alcohol, 16 "
Water, 16 "

Macerate the vanilla with the carbonate of potassa in the alcohol, for twenty-four hours, add the water, and remove 15 parts of the liquid by distillation. *(Batav. Phar.)*

Troches of Vanilla.

℞ Vanilla, 1 oz.
Sugar, 7 "
Gum Tragacanth, ½ drach.
Water, q. s.

Make in the usual way, troches of 8 grs. each, containing one grain of vanilla. J. C.

ART. XXXVIII.—ON THE ACTION OF SAL AMMONIAC ON IODIDE OF POTASSIUM, AND UPON A PECULIAR MODE OF EXTERNAL USE OF THIS SALT. By M. Vogel de Munich.

M. Breslau, Chief Physician to the King, who uses extensively the mineral water of Heilbrow, in which I found, in 1825, iodide of soda in notable quantity, has employed for some time the iodide of potassium in a peculiar manner as I have had occasion to witness.

M. Breslau, employs a powder composed of iodide of potassium and sal ammoniac, which he causes to be enclosed in fine linen, and applied to the affected part.

As I remarked that the lined bag containing this powder, and applied to the neck of a young person, had acquired, after a few days, a brown color, this phenomenon attracted my attention, and caused a desire to know what change had taken place in the two salts; I therefore undertook a series of experiments, with the view of ascertaining the cause.

When we triturate together eight parts of sal ammoniac and one part of iodide of potassium, equally well dried, (for it is in these proportions that the salts are used by M. B.) ammonia is disengaged, and turmeric paper placed near the mixture becomes brown. This takes place with the iodide of commerce, which is usually feebly alkaline; but if we use iodide of potassium,which has been purified by repeated crystallizations, the disengagement of ammonia is almost wholly avoided.

The mixture of sal ammoniac and iodide of potassium, in the above proportions, is perfectly colorless, and preserves its whiteness for an indefinite time, if kept from contact of air in close vessels.

When we moisten this mixture, either that recently prepared or which has been kept for some time, with a weak solution of starch, it does not become blue, from whence it follows, that in a recent mixture as well as one which has been well preserved, there is no free iodine.

If we expose the mixture to the air, it soon loses its white color ; at the end of 24 hours it commences to become yellow, and this more rapidly in appearance, when spread in thin layers on filtering paper, or still better if placed in contact with organic substances.

The solution of this mixture, which has been exposed to the air, is colored of an orange tint, and assumes with a solution of starch, an indigo blue ; there is, therefore free iodine present.

When a colorless aqueous solution of the fresh mixture is exposed to the air, it becomes yellow and strikes a blue color with a solution of starch ; while a solution of the fresh mixture, kept in well stopped vessels, was preserved for months without change.

If we place the fresh mixture in a porcelain capsule, over mercury, and cover it with a bellglass, filled with carbonic acid gas, no absorption or change takes place.

The fresh mixture was finally placed under a bell glass of air dried by chloride of calcium ; it was preserved for many days without becoming yellow, while the same introduced into a moist air, lost its pulverulent form, and became conglomerated into yellow balls, which became blue with a solution of starch.

I placed the white mixture in a flat porcelain plate, in the cellar, and covered it with a cylinder, which had a number of small openings near the bottom to create a current of air ; upon the open part of the cylinder was placed paper moistened with solution of starch. The paper separated from the surface of the mixture by a space of about three inches, became blue at the end of some days ; which did not take place when the vessel was covered with paper impregnated with fecula, and moist air excluded.

The mixture in the cellar became partially liquid, and afterwards passed to a dry state ; new pieces of paper steeped in a solution of starch, and placed at a certain distance from the mixture, assumed a blue tint for four months; from which it results, that iodine was disengaged for a long time, so that this

mixture enclosed in a linen bag, may be successfully used for a long time in chronic complaints, in which the slow and constant disengagement of iodine is applicable. At the end of six months, there was no traces of iodide of potassium in the mixture, and the residue consisted of sal ammoniac, and chloride of potassium.

Iodide of potassium is decomposed by sal ammoniac at an elevated temperature. When a mixture of these two salts is heated in a retort, by the flame of a spirit lamp, there passed into the receiver, besides sal ammoniac, iodine of the iodide of potassium; the whole of the iodide is not, under these circumstances, decomposed by the sal ammoniac. When the whole of the sal ammoniac is volatilized by a red heat, the residue contains, besides chloride of potassium, a little iodide of potassium.

Action of Ether on the Iodide of Potassium, and on the Iodide of Lead.

Well formed crystals of iodide of potassium very slightly attract moisture from the air, but undergo no other change; also a solution of this salt is not decomposed by contact with the air. On the contrary, when we moisten the crystals, well dried and powdered, with ether, they assume after some time a yellow color, and contain free iodine. I have boiled this salt four or five times in successive portions of ether, and each time iodine was dissolved; the residue thus treated had become slightly alkaline, but still contained much iodine.

This partial decomposition, by means of ether, also takes place with compounds of iodine, which are with difficulty dissolved in water.

When for example we digest the yellow plates of iodide of lead in ether, this liquid becomes of an orange yellow and contains iodine, but no lead. By repeated actions we come to a point at which the ether is no longer colored, and does not dissolve any more iodine. The residue upon which the ether no longer acts, has lost the brilliant gold color which it previously had, and become brownish yellow, with no lustre.

Boiling water now dissolves scarcely a trace of the iodide, and does not become colored. On heating this residue with the contact of air, and treating it with nitric acid, it reacts like pure oxide of lead, but still contains iodine which cannot be separated by the ether.

Aldehyd does exert similar decomposing action upon the crystallized iodide, but under these circumstances much ether is eliminated.

The action of other Chlorides upon the Iodide of Potassium.

No other chloride besides sal ammoniac appears to have the property of decomposing iodide of potassium, at ordinary temperatures, and in contact with the air. Iodide mixed with chloride of potassium, undergoes no change by exposure to the air for eight days; no iodine is set free.

A mixture of iodide of potassium and chloride of sodium, disengages, at the end of some days, a trace of iodine, but it appears to me that this decomposition is not due to the chloride, but to some foreign admixture. As sea-salt coming from all the manufactories of Bavaria, contains traces of sal ammoniac, I sublimed the sal ammoniac by means of a dull red heat, and when cool, mixed the salt with iodide of potassium. This mixture, left exposed on a stand for eight days, did not disengage any iodine, but a similar mixture spread upon paper colored it of a very bright yellow, after some days, and the paper contained traces of iodine. The iodide of potassium is decomposed, however, in a very marked manner at a high temperature, when mixed with chloride of sodium, or even with chloride of barium, and heated by the flame of alcohol in a glass retort.

Sal ammoniac, therefore, appears to be the only chloride which can produce a slow decomposition, at ordinary temperature and in contact with a moist atmosphere.

We may add, likewise, that sal ammoniac always slightly reddens tincture of litmus, and may act up to a certain point, as an acid salt, which would decompose the iodate of potassa, when a small quantity of this salt exists in the iodide. But

the slow disengagement of iodine is effected by the sal ammoniac even when the iodide is totally exempt from the iodate.

The large proportion of the sal ammoniac would appear to favor the disengagement of the iodine, in as much as the iodide is more minutely divided, and offers a large surface for the action of the moist air ; at least I have found that the liberation of iodine was slow in a mixture of two parts of sal ammoniac with one of iodide of potassium ; it is therefore proper to adhere to the above proportions of eight parts of sal ammoniac to one of iodide of potassium.

The advantages for the practitioner to employ this mixture as an external application, consists principally in its convenience, and in the successive disengagement of an active agent, such as iodine. As soon as the iodine is set free it may be absorbed by the affected part, without being exposed to the risk of applying too large an amount upon one point, from which more or less serious inconvenience might result to the patient.

Conclusions.

It results from these experiments,

1. That iodide of potassium mixed with sal ammoniac does not undergo any change by the contact of dry air.

2. That the same mixture is decomposed by moist air, so as to form an iodide of ammonium, from which the iodine is successively liberated.

3. That the oxygen of the air is not absorbed by this mixture, but the change is due to the decomposition of water, slowly absorbed from the atmosphere.

4. That after the lapse of several months, the iodide of potassium is decomposed into iodide of ammonium, which volatilizes, setting iodine free, and into chloride of potassium which remains with the excess of sal ammoniac.

5. That dry iodide of potassium, as well as crystallized iodide of lead, is partially decomposed by ether, which takes away a certain quantity of iodine.

6. That no other chloride besides sal ammoniac can decompose iodide of potassium at ordinary temperatures and in contact with moist air; but may at a high temperature.

7. Finally, that it is advantageous for the practitioner to employ a mixture of iodide of potassium and sal ammoniac, as an external application, when the object is to develope successive portions of iodine in small quantities, and for a long time, as the disengagement of iodine will continue without interruption for several months.

Journ. de Pharm.

ART. XL.—ON THE LIMIT TO THE ACTION OF CERTAIN CHEMICAL REAGENTS.

Mr. P. Hastings, having examined the action of certain chemical reagents, has given the following statement of the results.

I. The sensibility of *starch* as a reagent for *iodine*.

Iodide of potassium slightly acidulated with nitro-muriatic acid, tested by a diluted solution of starch, gave the following results.

1. Containing 1-500dth iodine gave a black precipitate, the upper surface brownish yellow.

2. Containing 1-1000dth iodine gave nearly the same color.

3. Containing 1-2000dth iodine, gave the precipitate the same color, but the solution slightly colored.

4. Containing 1-3000dth iodine, precipitate bluish black, the solution nearly clear.

5 and 6. Containing 1-4000dth to 1-5000dth iodine, precipitate bluish black, the solution quite clear.

7 to 11. Containing 1-10,000dth to 1-40,000dth iodine, very dark blue.

12 and 13. Containing 1-50,000dth to 1-60,000dth iodine blue, with a shade of violet.

14 and 15. Containing 1-80,000dth to 1-100,000dth of iodine, the upper stratum violet blue, the under stratum violet.

16. Containing 1-120,000dth iodine, the upper stratum violet, the under stratum rose color.

17. Containing 1-150,000dth iodine, the whole precipitate rose color, with a shade of violet.

18 and 19. Containing 1-200,000dth to 1-250,000dth iodine, rose color, the upper surface only with a shade of violet.

20 to 22. Containing 1-300,000dth to 1-400,000dth iodine. the whole precipitate of a rose color.

23 to 25. Containing 1-450,000dth to 1-550,000dth iodine, the upper stratum of the precipitate was slightly rose color, the under stratum was white.

The action took place immediately on the addition of the starch, as far as No. 19. The following numbers required some period to elapse first; it required some hours in the solution of 1-500,000dth to 1-550,000dth, before any effect was produced.

II. The sensibility of reagents *on acids.*

For Sulphuric acid.—Specific gravity 1.829. Containing 75.83 per cent. real acid.

Syrup of violets did not detect less than 1-250th sulphuric acid of the above specific gravity, or 1-310th real acid.

Paper stained with Brazil wood, was acted upon by 1-10,000dth or 1-12,500dth real acid.

Paper stained by tincture of red cabbage, was reddened by 1-15,000dth, or 1-18,750th real acid.

Paper stained by logwood, was changed to a golden yellow color, by 1-50,000dth or 1-52,500dth real acid.

Paper stained by litmus was immediately reddened by 1-20,900dth or 1-25,000dth real acid, and after some hours was slightly reddened by 1-50,000dth or 1-62,500dth real acid.

Carbonate of potassa occasioned a slight effervescence with 1-250th, or 1-310th real acid.

For Phosphoric acid.—Brazil wood paper, and paper stained with red cabbage, detected 1-10,000dth of anhydrous phosphoric acid.

Litmus paper was immediately reddened by 1-10,000dth, and after some hours by 1-30,000dth phosphoric acid.

Peculiar reagents for various acids.

For free Sulphuric acid.—A concentrated solution of chloride calcium, occasioned a precipitate, after some hours in a solution containing 1-130th real sulphuric acid.

A solution of acetate of lead, gave a precipitate with 1-50,000 real acid.

A solution of chloride of barium, gave a precipitate with 1-75,000dth.

For combined Sulphuric acid.—Acetate of lead produced a precipitate in a solution of sulphate of soda containing 1-36,000dth of acid.

Chloride of barium in a solution of the same salt, containing 1-45,000dth acid.

For Nitric acid.—By means of hydrochloric acid, and gold leaf, 1-240th of nitric acid, specific gravity 1.32, was detected ; the gold leaf was dissolved in 24 hours.

For Phosphoric acid.—Acetate of lead produced an immediate precipitate with 1-10,000dth anhydrous acid, and with 1-20,000dth, after remaining for half an hour.

Lime water produced exactly the same effect.

Chloride of barium did not occasion a precipitate in less than 1-10,000dth.

For Arsenious acid.—Lime water in excess produced a precipitate in a solution, containing 1-4000dth of this acid.

Ammoniacal solution of oxide of copper, detected 1-8000dth.

Sulphate of copper and ammonia, detected 1-12,000dth.

The two last reagents occasioned precipitate in still more diluted solutions, but the precipitates did not possess their characteristic green color.

Hydrosulphuric acid produced a precipitate in 1-30,000dth.

Ammonia nitrate of silver formed a yellow precipitate with 1-30,000dth ; with a more diluted solution, the color of this precipitate was not sufficiently apparent.

III. The sensibility of reagents *for metals and their oxides.*

For free alkalies in general.—Turmeric paper detected the presence of 1-3000dth caustic alkali.

Paper stained with red cabbage, detected the presence of 1-7500dth of caustic alkali.

Brazil wood was colored slightly violet, with 1-20,000dth.

Litmus paper reddened by acetic acid, was distinctly rendered blue by 1-80,000dth.

Hydrate of potassa contains 16 per cent. of water, therefore the quantity of real potassa detected by the above agents, was 1-3600dth, 1-9000dth, 1-24,000dth and 1-95,000dth.

For Potassa.—An alcoholic solution of chloride of platinum, occasioned a precipitate in a solution of nitrate of potassa, containing 1-206 of this base; a solution containing 1-200dth was not precipitated by it.

A very concentrated solution of tartaric acid, produced a precipitate with 1-220th, but none with 1-230th. The sensibility of the reagents was tried at 59° Fahr.

For Lime.—Oxalate of ammonia produced a cloudiness after a few minutes, in a solution of chloride of lime, containing 1-400,000dth of lime.

For Baryta.—Fluo-silicic acid produced a slight precipitate in solution of chloride of barium, containing 1-3800dth of baryta.

A solution of sulphate of soda produced, in half an hour, a cloudiness in a solution containing 1-71,000dth.

For Magnesia.—A solution of phosphate of soda, indicated in 24 hours, the presence of 1-200,000dth of magnesia, in a solution of sulphate of magnesia. This reagent must be very concentrated, and a quantity equal to the solution examined, must be added. These conditions are absolutely

necessary, as otherwise the reagent will not indicate the presence of even 1-1000dth magnesia in solution. This is probably the reason that M. Roth fixes the delicacy of this reagent at 1-4000dth of magnesia.

A solution of ammonia produced, after some minutes, a slight precipitate in a solution, containing 1-6000dth magnesia.

For Protoxide of Iron.—Tincture of galls, and a solution of ferro-prussiate of potassa, acidulated with a few drops of hydrochloric acid, indicated, after some minutes, the presence of protoxide of iron, in a solution containing 1-440,000dth of crystallized sulphate of iron.

For Peroxide of Iron.—Tincture of galls indicated the presence of 1-300,000dth of peroxide of iron, in solution of sulphate of peroxide of iron, by rendering it of a slight violet color.

A solution of ferro-prussiate of potassa indicated the presence of 1-420,000dth of the same salt.

For Copper.—A solution of ammonia gave, after several hours, a slight blue color to a solution of sulphate of copper, containing 1-9400dth of oxide of copper.

A solution of prussiate of potassa rendered the presence of 1-7800dth of the same salt visible.

Polished iron showed the presence of 1-125,000dth of oxide of copper, or 1-156,000dth of metallic copper, if the solution was acidulated by a drop of nitric acid.

For Lead.—A piece of zinc precipitated lead from a solution of the nitrate, when 1-3000dth of oxide was present.

An excess of sulphuric acid occasioned a precipitate in a solution of the same salt, containing 1-20,000dth of oxide.

A solution of chromate of potassa occasioned a cloudiness in a solution containing 1-70,000dth of the same oxide.

A solution of hydrosulphuric acid, blackened a solution containing 1-350,000dth.

For Silver.—Chromate of potassa produced a slight red precipitate in a solution of nitrate of silver containing 1-10,000dth

of oxide. No re-action took place in a solution containing above 1-20,000dth.

Arsenite of potassa produced a decided yellow precipitate with 1-6000dth oxide in solution, but none with 1-20,000dth.

Iodide of potassium indicated the presence of 1-4000dth oxide, but produced no action with 1-30,000dth.

A solution of hydrosulphuric acid, precipitated a solution containing 1-35,000dth of oxide.

Chloride of sodium produced a cloudiness in a solution, which contained only 1-240,000dth.—*Extracted by E. F. Teshmacher, from the Journal für Practische Chemie, No.* 1, 1841.

Lond. Ed. and Dubin Phil. Mag.

ART. XL.—ON THE MOST IMPORTANT CHEMICAL MANUFACTURES, CARRIED ON IN GLASGOW AND THE NEIGHBORHOOD. By Professor Thomas Thomson, of Glasgow, F. R. S.

From the Transactions of the British Association, for the advancement of Science, for 1840.

"Glasgow being the seat of a great many interesting and important chemical manufactures, it occured to me (said Professor Thomson) that it might be of advantage to those members of the chemical section, who have come from a distance, to give a short catalogue of the most important of these manufactures, that they might know what the information is which they expect, and where they are to look for it."

1. *Iron.* The smelting of iron has been practised in the neighborhood of Glasgow for more than fifty years; when the late Mr. Dunlap, of the Clyde Iron Works, first became proprietor of those works, perhaps the only one then in the vicinity, the product was only fourteen tons a week, or 728 tons a year. At present the quantity of iron smelted in Glasgow and the neighborhood, cannot be much less than 200,000 tons, which approaches to a fifth part of the whole iron smelted in Great Britain. The ore is very abundant all round Glasgow, and especially in the neighborhood of Airdrie, where the principal works are now situated. Fortunately for the smelters, the iron-stone and coal-beds are associated together, the iron-stone either occurring in nodules or beds along with the coal. The rapid increase of iron smelting has been the consequence of a discovery of Mr. Neilson, manager of the gas works. This is now universally known under the name of the hot blast. The air is heated to more than 607° before it enters the furnace, by passing through a range of heated pipes. Under this treatment it is found that the coal may be used without previous coking; and that instead

of seven tons of coal for every ton of cast iron, three, or even two and a half tons will suffice. There is also a diminution of the quantity of lime stone necessary, and the produce of iron per week from the same furnace, is considerably increassed. It is said that neither in Staffordshire nor in Wales, is the hot blast attended with the same saving of fuel. Till of late years, no bar iron was made in Scotland, the smelters confining themselves to cast iron. About three years ago, Mr. Dixon commenced the manufacture of bar iron near St. Rollox, but, after some time, he abandoned the manufactory. It is now conducted on a grand scale by Mr. Wilson, at Dudyvon, and by Mr. Dixon, at Glasgow, and perhaps by other iron masters. The heat raised in the puddling furnace, is much greater than it was in Staffordshire, when Dr. Thomson witnessed the process, there about twenty-five years ago. There is an interesting manufactory of steel near Holytown, not far from Airdrie, where the smelting and casting of steel may be seen; the heat necessary for this purpose, is greater than for any other. It is curious that the clay in the neighborhood, answers perfectly for making crucibles for cast steel; but it does not answer so well as Stourbridge clay for making glasshouse pots. On analysing the two clays, it was found that the Garnkirk, contained much more alumina, and less silica than the Stourbridge; showing that glass in fusion acts much more powerfully on alumina than on silica.

2. Another manufactory of importance, and which is indebted to Glasgow for the state of perfection, which it has reached, is *Sulphuric Acid.* It was begun by Dr. Roebuck, at Preston-pans, about the year 1763, but it is not more than twenty years since his manufactory was abandoned.

The Sulphuric acid works at St. Rollox, on the banks of the Monkland canal, were begun about forty-five years ago. They were at first upon a very small scale, though they are now, probably the largest of the kind in Europe. Dr. Roebuck's method was to mix together sulphur and saltpetre, and after setting the mixture on fire, to introduce it into a leaden vessel or chamber, at the bottom of which there was a quantity

of water. This method was not economical. A portion of the sulphur would unite with the potash of the saltpetre, and form with it a sulphuret, and probably a portion of the sulphuric acid formed, would also unite with the potash and form a sulphate. When Messrs. Knox, Tennant, and Macintosh established their works at St. Rollox, they separated the sulphur from the saltpetre; the sulphur was burnt over a stove, and an iron cup, containing the requisite quantity of saltpetre, was placed over the burning sulphur.

By this contrivance the sulphur was completely converted into sulphurous acid, and the whole of the nitric acid crried along with it into the leaden chambers. The size of the leaden chambers was gradually increased, and the substitution of steam for water formerly placed at the bottom of the chambers was a vast improvement. The acid which collects at the bottom of the chambers has a specific gravity of 1.75, or it is a compound of one atom anhydrous acid, and two atoms water. This acid is concentrated by heating it in a platinum still, till the second atom of water is driven off. When this manufacture is at full work, the quantity of sulphuric acid made in it exceeds 300,000lbs avoirdupois, per week. When he first began to purchase acid, about forty-five years ago, it cost 8*d*. per pound; the present price is under a penny a pound.

3. One of the great purposes to which sulphuric acid is applied at St. Rollox's, is the manufacture of *bleaching powder, or chloride of lime*, as it is now called. When the mode of bleaching by chlorine was introduced into Great Britain, by Mr. Watt, in 1787, the very offensive smell and deleterious effects of the gas upon the workmen, was a formidable obstacle to its use. Various methods were tried to remove this objection. It was found that if potash, or soda was dissolved in the water before it was impregnated with the chlorine gas, the disagreeable smell was destroyed; but unfortunately the addition destroyed, at the same time, the bleaching power of the gas. At last Messrs. Knox, Tennant, and Macintosh discovered that if lime was mixed with the water, before it was mixed with the gas, the disagreeable smell was obviated,

while the bleaching power still remained uninjured. They took out a patent for this discovery; but it was infringed upon by the Lancashire bleachers; a law-suit was the consequence, and the patent was destroyed. It was then that Mr. Macintosh tried whether chlorine would not be absorbed by slacked lime. The trial succeeded; a compound was formed which readily dissolved in water, and the solution of which, possessed great bleaching power; a patent was taken out for the manufacture of this dry powder, which the patentees distinguished by the name of bleaching powder. This patent was not infringed; the sale of it was at first small, and it was overlooked by the bleachers. The consequence was, that the patentees had leisure to perfect their method of preparing it, and to become able to sell it at so low a price that it gradually superseded all the old methods of bleaching by chlorine. The process may be seen at St. Rollox's in great perfection and on a very large scale. The requisite mixture of common salt, binoxide of manganese and sulphuric acid, is put into a leaden still, and the chlorine evolved passes through leaden tubes into air tight stone chambers, the bottoms of which are covered with a stratum of slacked lime, several inches thick. The lime absorbs the gas as it passes into the chamber, and the process is continued, until the absorption is reckoned sufficient.

Bleaching powder, supposing it pure, is a compound of

1. Chloride of calcium,	7
2. Chlorite of lime,	10
3. Water,	3.375
	20.375

Half the lime loses its oxygen, and combines with chlorine, constituting chloride of calcium. The oxygen combines with chlorine, which, in the state of chlorous acid, combines with the other half of the lime, constituting chlorite of lime. Two atoms of water were in the slacked lime. The third atom

must have come along with the chlorine gas, or been absorbed from the atmosphere.

4. After the chlorine has been extricated, there remains in the still a semi-liquid mass, consisting partly of the impurities of the manganese, and partly of sulphate of soda, and sulphate of manganese. If the manganese were pure binoxide, and only the quantity of salt and sulphuric acid necessary for the decomposition were used, the sulphate of manganese, (abstracting the water) would weigh nine and a half, and the sulphate of soda nine. But in order to save the stills by producing the decomposition with little heat, twice as much sulphuric acid is used as is necessary, and this excess is afterwards saturated by means of common salt; so that the quantity of sulphate of soda in the residue is at least twice as great as that of the sulphate of manganese. To get rid of the sulphate of manganese, the residue from the still is fused in a reverboratory furnace at a red heat; this drives off the sulphuric acid and leaves the manganese in the state of sesquioxide.

The whole is dissolved, and the insoluble manganese thrown away. The solution of sulphate of soda is evaporated to dryness, mixed with small coal, and fused again. This destroys the sulphuric acid and converts the soda into sulphuret. This sulphuret being mixed with sawdust, &c., and exposed to an incipient red heat, the sulphur is driven off, and carbonate of soda remains, which is obtained in crystals by solution and crystallization, or in the state of *soda ash*, by a more rapid process. The theory of the last step of the process, in converting sulphate of soda into carbonate, is not very obvious, and would require an experimental investigation to throw light on it.

5. Another chemical manufacture, which may be seen, is *alum making*. There are two establishments, one at Hurlet, about six miles southwest, by the Paisley canal; another at Campsie, about eight miles off, near Kirkintullock, on the great canal, and near the foot of the Campsie hills.

The alum is made from the *shale*, which exists in great

abundance in the exhausted coal beds. This shale is clay, mixed with some coal, and with that variety of iron pyrites which undergoes decomposition, and is converted into sulphate of iron by exposure to the air. The sulphate of iron, thus formed, acts slowly on the clay, and in process of time converts it into sulphate of alumina. When sufficiently concentrated and cooled, the liquor yields an abundant crop of sulphate of iron, which is removed, dried, and sold at a cheap rate. The sulphate of alumina does not crystallize till it is mixed with sulphate of potash, or sulphate of ammonia. Formerly, nothing but chloride of potassium, bought from the soap makers, was used. But of late years (at least at Hurlet,) sulphate of ammonia, from the liquor obtained during the preparation of gas, has been employed. In general the alum made at Hurlet, contains both potash and ammonia ; but the manufacturers can supply it free from potash. Such alum is convenient to chemists, because when it is heated to redness, every thing is driven off except pure alumina. At Hurlet and Campsie the mode of concentrating the liquid by a current of heated air passing over its surfaces, deserves attention.

6. At Campsie alum-works, may be seen another interesting chemical manufacture, the fabrication of prussiate of potash, a beautiful well known yellow salt, which crystallizes in truncated octahedrons. It was here that the manufacture of this salt, on a great scale, first began. Before that time it was only prepared in laboratories for scientific purposes, and sold at a high price. Mr. Macintosh introduced it to the calico printers, who used it extensively to produce very beautiful blues and greens. It is prepared by burning the hoofs and horns of cattle in iron pots, along with a quantity of potash. The hoofs and horns of a hundred head of cattle are consumed every day in the works.

For some time no iron was added, the requisite quantity for forming the salt being corroded from the pots during the combustion. But the last time that the author visited the works, he found that iron was mixed with the hoofs, &c., during combustion. The residue after this combustion is lixiviat-

ed with water, and when the solution is sufficiently concentrated, the prussiate of potash crystallizes. Connected with this manufactory of prussiate of potash, is another of Prussian blue. It is made by mixing sulphate of iron, alum and prussiate of potash, and precipitating the whole by an alkali. The precipitate is at first a light blue. But it is washed with new portions of water every day, for several weeks. At every washing the color deepens, and when it has acquired the requisite shade, the prussian blue is allowed to subside, the water is drawn off and the powder allowed to dry. The color varies according to the proportion of alum employed; and it has the finest color of all, with the coppery lustre which is so much admired, when no alumina whatever is mixed in it.

7. Another beautiful chemical product may be seen at Shawfield near Rutherglen, about two miles from Glassgow, in the manufactory of Mr. White. This is *bichromate of potash*, a salt very much used by the calico-printers, and forming the finest and most indelible yellows, oranges, and greens. Its introduction constituted quite a new era in calico-printing. This salt was originally made by heating chromium ore with saltpetre, dissolving out the chromate of potash, and adding the requisite quantity of nitric acid to deprive the chromic acid of half its potash. When this process began the salt was sold at a guinea an ounce; but now when the price is as low as two shillings a pound it is necessary to prepare it by a cheaper method.

It has been found that common potash of commerce may be substituted for saltpetre; and Dr. Thomson believes the manufacturers now contrive to form the bichromate at once, without requiring the use of an acid, which would nearly double the expense. It is stated, that all the bichromate used by the calico-printers is made here and in Liverpool. In the same manufactory may be seen a beautiful product, *tartaric acid*, which is used by the calico-printers to a large amount, chiefly to disengage the chlorous acid from bleaching powder, and enable it to destroy the color on particular parts of the cloth, either that these parts may remain white, or that some

other color may be superadded. Tartaric acid is obtained from cream of tartar, by throwing down the tartaric acid by means of lime, and afterwards decomposing the tartrate of lime by means of sulphuric acid, and crystallizing the tartaric. At the same manufactory may be seen a pretty and simple process, by which the carbonate of soda is converted into sesquicarbonate. By simply exposing it dry, and in powder, in an atmosphere of carbonate acid gas, it absorbs the requisite quantity to be converted into sesquicarbonate.

8. It is hardly proper to mention the manufactory of *acetic acid* from wood, which has been carried on for many years, by Mr. Turnbull, because the first part of the process is carried on at a distance, the distillation of the wood. To free the acetic acid from the tar, which destroys its flavor and taste, the acid is combined with lime, and the acetate of lime exposed to a heat sufficiently high to char the foreign bodies with which it is impregnated, the acetic acid being capable of resisting a higher temperature, without decomposition, than most compound vegetable bodies. The acetate of lime thus purified is decomposed by sulphuric acid, and the acetic acid obtained by distillation. By this process it may be obtained very strong. The author possesses it composed of one atom acetic acid and one atom water. When of this strength it crystallizes in winter, but becomes liquid again in summer. In the same manufactory there is another liquid prepared, namely, *pyroxylic spirit*, now well known.

A most interesting set of experiments on it has been made by Dumas, who has distinguished its basis by the name of *methylene*, and has discovered various new compounds which it is capable of forming.

9. Another chemical manufacture of considerable importance, and which the author believes to be peculiar to Glasgow, is *Iodine*. A few years ago there were no fewer than ten manufactories, in each of which it was made to a considerable extent; but as iodine is only used in medicine, the sale is necessarily limited, and most of these works are now abandoned. The process followed by all the makers was,

Dr. Thomson believes, the process of Mr. Macintosh. Iodine is made from kelp, and it deserves attention, that those kinds of kelp that contain most potash, contain, at the same time, the most iodine. The kelp is lixiviated, and all the salts which can be extracted from the solution by evaporation are separated. The mother water remaining is now mixed with an excess of sulphuric acid. A great quantity of sulphuretted hydrogen is evolved, the bad effects of which on the workmen, are obviated by setting it on fire, and allowing it it to burn as it is extricated from the liquid. To the liquid thus freed from sulphuretted hydrogen, and from muriatic acid, a quantity of binoxide of manganese, equal in weight to the sulphuric acid employed, is added. The whole is put into a leaden still, and heated to a temperature which must not exceed 190° or 200° at most. The iodine passes into the receiver which consists of a series of spherical glasses, having two mouths opposite to each other, and inserted the one into the other.

10. It may seem superfluous to mention *soap*, because it is a manufacture universally known ; but soap of a very superior quality is made in Glasgow. The number of soap-works amounts to seven, and one of these, that at St. Rollox, is the third, if not the second, in point of extent in Great Britain. The ingredients of soap, are soda, tallow, and rosin, and sometimes palm oil. Two kinds only of hard soap are made here, namely, *yellow* and *white*.

The yellow soap is made by boiling 9.75cwt. of tallow, 3.25cwt. of rosin, 4cwt. of soda ash, equivalent to 2cwt. of soda, mixed with the requisite quantity of water; the white by boiling 13cwt. of tallow, 4cwt. of soda ash in the same manner. Tallow, which is a compound of two oily acids and glycyffrine, undergoes decomposition, and the soda combines with the acid and forms soap. When the combination is complete, a quantity of common salt is put into the hot liquor. It dissolves in the water and the soap separates, and swims on the top. It is now allowed to cool to 150° at an average, and then taken out in a liquid state, and poured into frames, where it is allowed

to become solid, and then cut into the usual parallelopipeds, or wedges, as they are called. It is customary, during the *cleansing* of the soap, as the pouring it into the frame is called, to mix it with a quantity of caustic soda ley. The soap made in Glasgow is usually a compound of

1 atom oily acid,	53	or per cent.	74.6
2 atoms soda,	8	"	11.2
9 atoms water,	10.125	"	14.2

White soap is cleansed at the average temperature of 181°. Its constitution is precisely the same as that of yellow soap.

11. Bleaching of cotton cloth is carried on here to a great extent. It consists of four processes:—1st. The goods are boiled with lime, at a temperature above the boiling point of water. 2d. The cloth is steeped in a solution of bleaching powder. 3d. It is boiled with caustic soda or potash. 4th. It it is steeped in water acidulated with sulphuric acid.

12. Turkey-red dying has been practised here for almost half a century.

13. *Calico-printing* is carried on here to a great extent; *glass-making* is carried on here, or on the Clyde, in all its branches; for *starch-making* there is only one manufactory. The manufacture of the dye-stuffs called *cudbear*, employed in dying red, has long been carried on here; so has the distillation of spirits and the manufacture of ether.

ART. XLI.—ON POLLEN AND VEGETABLE IMPREGNATION.

[A MEMOIR on this subject was read before the British Association, for the advancement of science, by DR. ALDRIDGE of Dublin, detailing the results of observations he had made respecting it, which appear to us novel and interesting. The following is the substance of the memoir—A. S.]

Dr. Aldridge having discovered that nitric and other inorganic acids, produced the dehiscence of the pollen-grains, in the same manner as if they were placed on the natural stigmatic surface, instituted a number of experiments upon this subject. His results are:

1. The spores of cryptogamic vegetables, which some botanists consider analogous to pollen, do not dehisce under the influence of acids.

2. The pollen of the grapes is spherical, both when dry and placed in water ; with acids it bursts, protruding in one long cylindrical mass, which remains afterward unacted upon by the liquid.

3. The pollen of the Adroideæ, Colchicaceæ, Smilaceæ, Liliaceæ, Commelinaceæ, Butomaceæ, Amaryllidaceæ, Iridaceæ and Cannæ, are, when dry, oval, and marked with a dry neutral line, but become, when placed in water, more broadly oval or circular, the long diameter remaining the same, and the opake line disappearing ; after the addition of an acid the external membrane of the pollen, or peripollen, dehisces by a chink or suture, sufficiently broad to permit the contents or endopollen to escape without any change of form, after which the endopollen remains unacted upon by the liquid.

4. In the Salicineæ, Salicariæ, Leguminoseæ, Rosaceæ, Crassulaceæ, Saxifragiæ, Hypericaceæ, Rutaceæ, Hypocastaniæ, Resedaceæ, and the tribe Helleboreæ, of the Ranunculaceæ, the pollen when dry, oval, and marked with a dark central line, becomes, when placed in water, round, or nearly so—the

dark line disappearing; and when acted upon by acids, assumes a triangular form, and protrudes at three equidistant points cylindrical or club-shaped masses, very similar at their origin to tubes, and presenting the appearance of being enveloped by a membrane.

5. In the greater number of the remaining dicotyledons examined, the dry pollen is opake, and either broadly oval or spherical.

6. In the Ericaceæ, and Epocridaceæ, the pollen grains, when dry, appear triangular or oval in some instances, triangular or rhombic in others, according to the position in which they are examined. Having ascertained the results of acid on the pollen, the author was induced to examine the stigma, and in every case found that the stigmatic tissue gave indications of an acid reaction upon litmus paper. The next question to be examined was, in what manner the fertilizing influence of the male organs is communicated to the ovule? After quoting the opinions of Amici, Brown, Tritzche, Corda, Treviranus, Brongniart and others, the author came to the conclusion that the *bogan* or intestine-like protrusion from the pollen grains is the result of the action of acids upon the fluid which contains the fovilla in the pollen grain ; and he infers this from the fact of this tube or *bogan* never being formed when the pollen grain is placed in water, but being constant when the grain is placed in acid. After describing and explaining the anomalous character of the pollen grains in the Orchidaceæ, Fumaraceæ, &c., the author presents the following conclusions as the result of his researches: 1. The stigma is invariably acid. 2. It is in consequence of this acidity, that the pollen bursts. 3. That by the same means the fluid contents of the pollen become coagulated, enveloping the fovilla, and assuming, according to the method of dehiscence, different, and very remarkable forms.

ART. XLII.—VIEWS OF PROFESSOR LIEBIG ON POISONS, CONTAGIONS, AND MIASMS.

[The following interesting remarks on the *modus operandi* of poisons, &c., prepared for the "British Association for the advancement of Science," by Dr. Playfair, at the request of Professor Liebig, contain the new views of the latter on this subject.—A. S.]

Poisons may be divided into two classes, belonging to the inorganic and organic kingdom. Many substances are called inorganic poisons, which have in reality no claim to be considered as such. Sulphuric, nitric, and muriatic acids, when brought in contact with the animal œconomy, merely destroy the continuity of the organs, and may be compared in their modus operandi to the action of a heated iron, or a sharp knife. But there are others—and these are the true inorganic poisons—which enter into combination with the substance of the organ without affecting any visible lesion of them.

Thus it is shown, that when arsenious acid or corrosive sublimate is added to a solution of muscular fibre, cellular tissue, or fibrin, these enter into combination with them, and become insoluble; when they are introduced into the animal organism the same circumstance must happen. But the bodies formed by the union of such poisons with animal substances, are incapable of putrefaction; they are incapable, therefore, of effecting and suffering changes; in other words organic life is destroyed. The high atomic weight of animal substances explains the cause of such small quantities being requisite for producing deadly effects.

To unite with 100 grains of fibrin, as it exists in the human body, (in which it is combined, with 30,000 parts of water,) only 3½ grains of arsenious acid are necessary, or five grains of corrosive sublimate.

The second class of poisons are those belonging to the organic kingdom. For some such substances as brucia and strychnia, no data exists by which it can be determined to what cause their action may be assigned. But the morbid poisons, such as putrid animal, and contagious matter, appear to owe their action to a peculiar agent, which exerts a much more general and powerful action than chemists are aware of. Thus when oxide of silver is thrown into peroxide of hydrogen, the oxide is reduced and metallic silver remains. Here there can be no affinity, for oxygen can have no affinity for oxygen.

It is merely that a body in a state of motion or decomposition is capable of inducting or imparting its own state of motion or decomposition to any body with which it may be in contact. There is a disease frequently produced in Germany, by using decayed sausages as an article of food. The symptoms attending the disease are remarkable, and distinctly indicate its cause. The patient afflicted with the disease becomes much emaciated, dries to a complete mummy, and finally dies. The muscular fibre, and all parts similarly composed, disappear. The cause of the disease evidently is, that the state of decomposition, in which the component parts of the sausages are, is communicated to the constituents of the blood, and this state not being subdued by the vital principle, the disease proceeds, until death ensues. It is remarkable that the bodies of the individuals who have died in consequence of it, are not subject to putrefaction.

The cause of the action of contagious matter is similar. It is merely a gaseous matter in the state of transformation, and capable of imparting the state of transposition, in which its atoms are, to the elements of the blood. It is capable of being reproduced in the blood, just as yeast causes its own reproduction in fermenting *wort*. The causes of the action of yeast and of contagion are considered, by Professor Liebig, to be the same, and he has produced examples, in which similar reproductions take place, in

common chemical processes. There are two kinds of yeast used in brewing Bavarian beer. The fermentation caused by one is tumultuous, that produced by the other is tranquil. They, therefore, induct the peculiar state of transposition in which their atoms are upon the elements of the sugar. The same is the case with the vaccine virus of the cow and small-pox; the one of which produces a violent action upon the constituents of the blood, whilst the other causes a gentle action, quite distinct from the former.

ART. XLIII.—ON THE CONSTITUTION AND PRODUCT OF THE DISTILLATION OF FAT BODIES. By Professor Redtenbacher and Dr. Varrentrapp.

The object of this paper was to show that the composition of the fat acids has hitherto been erroneously stated. A variety of acids were subjected to examination, such as stearic, margaric, oleic, and sebacic acid. Margaric and stearic acids, were shown to possess the same radical; the former being the higher, the latter the lower oxide of it. This radical has the formula of $C^{34}H^{33}$, and may be represented by the symbol $\overline{Ma}$; Thus stearic acid is $2\overline{Ma}+5O$; whilst margaric acid is $1\overline{Ma}+3O$. They thus resemble sulphuric and hyposulphuric acids. Margaric acid is one of the products of the distillation of stearic acid; the oxidation of the latter also causes the formation of the former. Oleic acid was analysed by these gentlemen, having been obtained in a pure state. The results are principally numerical, and are stated in Liebig's Journal for 1840.

Trans. of British Association, for 1840.

ART. XLIV.—ON A NEW FAT ACID.

By Dr. Playfair.

Dr. Playfair had examined some of the vegetable fats for the purpose of ascertaining whether the margaric acid contained in them possessed a constant composition. He remarked that the acid in the butter of nutmegs, was peculiar, and had not formerly been examined. Pelouze and Bondet have stated, in the *Annales de Chemie*, that it is margaric acid.

Dr. Playfair considered that the radicals of serecic and œnanthic acids were similar; in the former, however, one equivalent of hydrogen is replaced by one equivalent of oxygen. It is a beautiful white crystalline compound, melting at 49° cent., and is soluble both in alcohol and ether. The combination of the acid with oxide of glyceril, exists in the butter; it unites with metallic oxides and forms salts. The formula of the acid is $C^{28}H^{54}O^{3}$.

Ibid.

ART. XLV.—A NEW MODE OF ESTIMATING NITROGEN IN ORGANIC ANALYSIS. By Professor Bunsen, of Marlburg.

The qualitative methods at present employed for the analysis of azotized bodies are admitted to be defective; for it is impossible to employ these processes when the nitrogen and the carbon are in small proportions to each other. Professor Bunsen's process consists in introducing the substance to be analyzed after having mixed it with oxide of copper, into a glass tube. A few slips of metallic copper are then added, and the tube is fixed to Dobereiner's apparatus for producing hydrogen. This gas is conducted through it until all the atmospheric air is expelled, the tube having a rotary motion given to it at the same time, in order to dislodge any air which might be retained between the particles of the oxide of copper. The tube is now hermetically sealed, and introduced into an iron vessel filled with gypsum. The gypsum must be still moist when the tube is introduced, in order that it may be firmly wedged. Thus prepared, it is introduced into the common oven, used for organic analysis, and surrounded with red hot coals. If the tube be of strong green glass it never bursts. When the combustion is completed, the tube is placed below a graduated glass receiver standing over mercury, and the point cut off. The gas which had a pressure of several atmospheres, now rushes into the jar. The carbonic acid is absorbed by a ball of hydrated potash, which is introduced into it, and the remaining gas must be nitrogen, for all the hydrogen must have been converted into water by the oxygen of the oxide of copper. The results obtained by this method agree with theory to the second and often to the third decimal place.

Ibid.

ART. XLVI.—ON BLEACHING VEGETABLE WAX.

By Mr. E. Solly.

Mr. S. has made a series of experiments on the best method of bleaching vegetable wax, the green color of which is very difficult of destruction, and of course a considerable objection to its use in the manufacture of candles. On trying most of the methods usually described as being fitted for the purpose, he found them all more or less objectionable, or inapplicable on a large scale. Some were tedious, requiring a long time for their completion, others expensive, whilst others, again, were inconvenient, from the difficulty with which the materials employed in bleaching were separated from the bleached wax. The author found the best effects were produced by chlorine ; but in this case it was necessary that the materials used to evolve the gas should be intimately mixed with the wax, and then of course the difficulty of separating the residue occurred, and when a stream of chlorine was slowly passed over the wax, the process was very slow and tedious. He subsequently found that strong nitric acid was a very powerful decolorising agent, and it possessed the advantage of leaving no residue which was at all difficult of separation ; the expense of this process was, however, a great objection to its use. The following method was ultimately employed.

The wax was melted, a small quantity of sulphuric acid was poured in, composed of one part oil of vitriol to two of water, and then a few crystals of nitrate of soda were stirred in; the whole was agitated with a wooden stirrer, and kept heated. Nitric acid was thus evolved in considerable quantity and purity from a large surface, and in such a manner that all the acid evolved must necessarily pass through the melted wax. This method answered the purpose very completely ; the process was cheap and rapid, and the residuum being merely a

little solution of sulphate of soda was very easily removed. When it is desired to employ chlorine in place of nitric acid as the bleaching agent, the same process may be adopted.

Ibid.

ART. XLVII.—COMPOUND OF IODIDE OF SODIUM AND IODATE OF SODA.

Prof. Fred. Penny, in the Transactions of the British Association, for 1840, describes a compound of iodine and soda, which appears to be the sesqui-sodii-iodide of iodate of soda. When examining the action of iodine on carbonate of soda, he obtained a salt which crystallized in regular six-sided prisms, which was white, inodorous, of a sharp saline taste, neutral to test paper, readily soluble in hot and cold water, but decomposed by alcohol into iodate of soda and iodide of sodium. Its solution gives a lemon-yellow precipitate with acetate of lead, yellowish white with nitrate of silver, and fine bright yellow with pernitrate of mercury. It is not affected by solution of starch, but instantly decomposed with precipitation of iodine by the stronger acids. It may also be obtained by the action of iodine on caustic soda. When the solution was evaporated spontaneously, Professor Penny found that long prismatic crystals of iodate of soda were deposited ; but as the evaporation continued, these crystals were re-dissolved, and replaced by those of the double salt. The prior deposition of the iodate of soda, generally occurs in the preparation of this salt, and it appears necessary that there should be an excess of iodide of sodium present in the solution, and that the solution should be strong, in order that the salt should form. When this salt is dissolved in water, and the solution evaporated spontaneously, crystals of iodate of soda deposit, but very few of the double salt will form

The salt may also be procured, by pouring a saturated solution of iodide of sodium, on crystals of iodate of soda, and setting them aside for some days. The crystals will be dissolved and replaced by crystals of the new salt. The following formula is deduced from the results of Professor Penny's analysis: $Na^5I^5O^{12}+38HO$; or regarding it as a compound of iodate and iodide, it may be thus represented $3NaI+2\dot{Na}\,\ddot{\dot{I}}+38HO$.

ART. XLVIII.—ON THE ACTION OF NITRIC ACID ON THE CHLORATES, IODATES, AND BROMATES OF POTASSA AND SODA. By Professor Frederick Penny.

In order to examine the action of nitric acid upon chlorate of potassa, a known weight of the salt was mixed in a retort with a measured quantity of the acid, and the mixture heated on a sand bath; as soon as it became warm, chlorine and oxygen were evolved in a state of mixture, and not of combination, and the chlorate slowly disappeared. The solution was then evaporated to dryness, and the saline residue was found to be a mixture of hyperchlorate and nitrate of potassa, in the proportion of three equivalents of the latter to one of the former. Professor Penny expresses the reaction that occurs, as follows:

$$4\,(K+Cl+O^6) \text{ and } 3(N+O^5)=(K+Cl+O^8) \text{ and } 3(K+N+O^6) \text{ and } Cl^3+O^{13}.$$

The action of nitric acid on chlorate of potassa differs, then, from the action of sulphuric acid on the same salt. With nitric acid the salt is decomposed tranquilly, and the chlorine and oxygen are liberated uncombined; whereas, with sulphuric acid these gasses are evolved in a state of combination, forming that dangerous explosive compound, chlorous

acid. The action of nitric acid upon chlorate of soda, is the same as upon chlorate of potassa. The chlorine and oxygen are set free in a state of mixture, and every four atoms of chlorate of soda, yield three of nitrate, and one of hyperchlorate. The hyperchlorate of soda is a very soluble salt, and crystallizes in small rhombs. It is readily decomposed by heat, but is unacted upon by hydrochloric acid. It deliquesces by exposure to the air.

The action of nitric acid on an iodate is very different from that on a chlorate, and is illustrated in the case of iodate of potassa. When iodate of potassa is boiled for some time with a large excess of nitric acid, it is decomposed into potassa and iodic acid ; the potassa combines with the nitric acid, and the iodic acid is deposited from the solution in minute, hard, and transparent crystals. If the acid solution of nitre, containing the iodic acid, be then evaporated, a reaction takes place; the iodic acid decomposes half the nitre, liberating the nitric acid, and combines with the potassa, forming biniodate of potassa. This change is completed when the mixture is dry, and if the heat be then withdrawn, a definite mixture of biniodate and nitrate is obtained. If the heat be continued, a still further change occurs; the iodic acid expels the whole of the nitric acid, and neutral iodate remains. By acting on iodate of soda with nitric acid, Professor Penny has obtained a biniodate of soda, and by adding a considerable excess of iodic acid to a solution of iodate of soda, he has found a teriodate of soda.

Both these salts are anhydrous. The biniodate of potassa contains one atom of water. He also finds that crystals of iodate of soda contain different quantities of water according to the strength of the solution from which they were deposited. He obtained it with 2, 4, 6, and 8 atoms of water.

The action of nitric acid upon bromate of potassa was next examined, and found to differ remarkably from its action on the chlorate and iodate. Neither hyperbromate nor bibromate is produced, but merely nitrate of potassa.

The nitric acid sets free the whole of the bromic, and this at the moment of liberation is resolved into bromine and oxygen.

In conclusion, the author remarks that the action of nitric acid upon these salts, affords a ready method of distinguishing them from one another.

Trans. of British Association, for 1840.

ART. XLIX.—ON THE SOLVENT POWER EXERCISED BY WATER, AT HIGH TEMPERATURES, ON SILICEOUS MINERALS. By JULIUS JEFFREYS.

"THE few remarks I have to offer, have reference to a paper read before the Royal Society of London, last spring. It briefly related an experiment made to determine the action of water, in the form of its vapor, upon siliceous minerals, at a very intense heat. The experiment was upon a large scale, and consequently very costly, and the results were curious. as establishing a very powerful action, by water, on siliceous minerals, when the temperature is sufficiently high."

Mr. Jeffrey's exhibited a large drawing to the British Association, showing the construction of a large boiler, erected near Furrukabad, a large city 800 miles west of Calcutta. It was the only one of the kind in India, and was employed for vitrifying brown stone, the manufacture of which Mr. Jeffreys had succeeded in introducing into the country. It was heated by four exterior furnaces, each six feet long and five wide. The kiln inside was fifteen feet in diameter and twenty-four feet high. The fuel was wood, and the utmost effect any alkali, which might be supposed to rise in its vapor, ordinarily produced, was a slight glazing of some of the brick surfaces in the kiln, near the entrance of the flame; an appearance which is also seen with other fuel, and with which

all manufacturers are familiar. "For the sake of experiment, I pulled down the four furnaces and rebuilt them, after having made between each and the kiln a deep pit as wide as each furnace, and only nine inches from front to back. About three feet of water was put into each pit, and was renewable from without. Some felspathic and siliceous minerals were placed in the way of the current, just inside of the kiln, and upon some of the arches a few articles of ware were placed, that any action upon them might be observed. Below a full red heat, little effect was perceived, but at a heat above that of fused cast iron, a rapid solution of mineral matter took place. The heat was continued ten hours. When the kiln was opened, more than a hundred weight of mineral matter, though in a very dense and refractory form, had been dissolved, and carried away in the vapor. The wall was eaten away, and presented a rough and quite unglazed surface, like loaf sugar partially melted by water, or as if eroded by some animal; and nothing of the smooth glazed surface, which invariably attends the action of alkali on a siliceous surface. Some articles of ware, in the hottest situation, were partially eaten through; but upon the uppermost arch, where the heat was only a full red, a curious phenomenon appeared. The articles there had received exterior to their own brown glass, and loosely encrusting it, a complete frosted coat of silica, having the appearance of a candied surface. It was manifestly a precipitation from the mineral vapor, and in fact a hoar frost of silica. There was probably from half an ounce to an ounce on each vessel, and several pounds, altogether, were thus precipitated; but by far the greatest portion of the mineral vaporised was, as might be supposed, carried away in the current. Hence, this powerful action was apparently entirely due to the presence of water, there being at all times the same quantity of alkali present in the fuel, whatever that might have amounted to, producing no such effect; the experiment seems to establish, at very high temperatures, a powerful action of water on siliceous matter. To attribute the action to alkali, would not lessen the difficulty,

both because under perfectly similar circumstances, when there was no water, no effect was produced, and because each pound of alkali would have had to dissolve, perhaps, forty pounds of silica. Mr. Jeffreys was informed by a military engineer of distinguished ability, to whom he related the experiment, that he had once observed a similar distinctive effect upon the brick casing of a kiln, by moisture getting in at an intense heat, though no scientific notice was taken of it at the time; and as coal was the fuel in this case, there was still less ground for supposing the action to be alkaline.

Lastly, if alkali did play an appreciable part, the experiment would remain still sufficiently curious, as it showed an abundant vaporization of silica, by a fraction of its weight of alkali, without the influence of fluorine, a phenomenon which has, so far as the author is aware, been only obscurely manifested in minute quantities, as noticed by the late Dr. Macculloch.

Ibid.

ART. L.—SOURCE AND ASSIMILATION OF THE NITROGEN OF PLANTS.

Extracted from Liebig's Organic Chemistry of Agriculture and Physiology.

"We cannot suppose that a plant would attain maturity, even in the richest vegetable mould, without the presence of matter containing nitrogen; since we know that nitrogen exists in every part of the vegetable structure. The first and most important question to be solved, therefore, is: How and in what form does nature furnish nitrogen to vegetable albumen, and gluten, to fruits and seed?

This question is susceptible, of a very simple solution. Plants, as we know, grow perfectly well in pure charcoal, if supplied at the same time with rain-water. Rain-water can contain nitrogen only in two forms, either as dissolved atmospheric air, or as ammonia. Now, the nitrogen of the air cannot be made to enter into combination with any element except oxygen, even by employment of the most powerful chemical means. We have not the slightest reason for believing that the nitrogen of the atmosphere takes part in the processes of assimilation of plants and animals; on the contrary, we know that many plants emit the nitrogen, which is absorbed by their roots, either in the gaseous form, or in solution in water. But there are, on the other hand, numerous facts, showing, that the formation in plants of substances containing nitrogen, such as gluten, takes place in proportion to the quantity of this element which is conveyed to their roots, in the state of ammonia, derived from the putrefaction of animal matter.

Ammonia, too, is capable of undergoing such a multitude of transformations, when in contact with other bodies, that in this respect it is not inferior to water, which possesses the

same property in an eminent degree. It possesses properties which we do not find in any other compound of nitrogen; when pure, it is extremely soluble in water; it forms soluble compounds with all the acids; and when in contact with certain other substances, it completely resigns its character as an alkali; and is capable of assuming the most various and opposite forms. Formate of ammonia changes, under the influence of a high temperature, into hydrocyanic acid and water, without the separation of any of its elements. Ammonia forms urea with cyanic acid, and a series of crystalline compounds, with the volatile oils of mustard and bitter almonds. It changes into splendid blue or red coloring matters when in contact with the bitter constituent of the bark of the apple-tree (*phloridzin*,) with the sweet principle of the *Variolaria dealbata (orcin,)* or with the tasteless matter of the *Rocella tinctoria (erythrin.)* All blue coloring matters which are rendered red by acids, and all red coloring substances which are rendered blue by alkalies, contain nitrogen, but not in the form of a base.

These facts are not sufficient to establish the opinion that it is ammonia which affords all vegetables, without exception, the nitrogen which enters into the composition of their constituent substances. Considerations of another kind, however, give to this opinion a degree of certainty, which completely excludes all other views of the matter.

Let us picture to ourselves the condition of a well cultured farm, so large as to be independent of assistance from other quarters. On this extent of land, there is a certain quantity of nitrogen contained both in the corn and fruit which it produces, and in the men and animals which feed upon them, and also in their excrements. We shall suppose thisquantity to be known. The land is cultivated without the importation of any foreign substance containing nitrogen. Now, the products of this farm must be exchanged every year for money, and other necessaries of life, for bodies, therefore, which contain no nitrogen. A certain proportion of nitrogen is exported with corn and cattle; and this exportation takes

place every year, without the smallest compensation; yet, after a given number of years, the quantity of nitrogen will be found to have increased. Whence, we may ask, comes this increase of nitrogen? The nitrogen in the excrement cannot reproduce itself, and the earth cannot yield it. Plants, and consequently animals, must, therefore, derive their nitrogen from the atmosphere.

The last products of the decay and putrefaction of animal bodies, present themselves in two different forms. They are in the form of a combination of hydrogen and nitrogen,—*ammonia*, in the temperate and cold climates, and in that of a compound, containing oxygen, *nitric acid*, in the tropics and hot climates. The formation of the latter is preceded by the production of the first. Ammonia is the last product of the putrefaction of animal bodies; nitric acid is the product of the transformation of ammonia. A generation of a thousand million men is renewed every thirty years: thousands of millions of animals cease to live, and are reproduced in a much shorter period. Where is the nitrogen which they contained during life? There is no question which can be answered with more positive certainty.

All animal bodies, during their decay, yield the nitrogen which they contain to the atmosphere, in the form of ammonia. Even in the bodies buried sixty feet under ground in the church-yard of the Eglise des Innocens, at Paris, all the nitrogen contained in the adipocire was in the state of ammonia. Ammonia is the simplest of all the compounds of nitrogen; and hydrogen is the element for which nitrogen possesses the most powerful affinity.

The nitrogen of putrefied animals is contained in the atmosphere as ammonia, in the form of a gas which is capable of entering into combination with carbonic acid, and of forming a volatile salt. Ammonia in its gaseous form, as well as all its volatile compounds, are of extreme solubility in water. Ammonia, therefore, cannot remain long in the atmosphere, as every shower of rain must condense it, and convey it to the surface of the earth. Hence, also, rain-water must, at all

times contain ammonia, though not always in equal quantity. It must be greater in summer than in spring or in winter, because the intervals of time between the showers are in summer greater; and when several wet days occur, the rain of the first must contain more of it than that of the second. The rain of a thunder-storm, after a long protracted drought, ought for this reason to contain the greatest quantity, which is conveyed to the earth at one time.

But all the analyses of atmospheric air, hitherto made, have failed to demonstrate the presence of ammonia, although, according to our view, it can never be absent. Is it possible that it could have have escaped our most delicate and most exact apparatus? The quantity of nitrogen [of the the ammonia] contained in a cubic foot of air is certainly extremely small, but notwithstanding this, the sum of the quantities of nitrogen from thousands and millions of dead animals, is more than sufficient to supply all those living at one time with this element.

From the tension of aqueous vapor at 15° C.(59° F.)=6.98 lines (Paris measure,) and from its known specific gravity at 0° C. (32° F.) it follows, that when the temperature of the air is 59 F., and the height of the barometer 28,″ 1 cubic metre, or 64 Hessian cubic feet of aqueous vapor, are contained in 487 cubic metres, or 31,158 cubic feet or air; 64 feet of aqueous vapor weigh about 1½lb. Consequently, if we suppose that the air, saturated with moisture at 59° F., allows all the water which it contains in the gaseous form to fall as rain; then 1 Hessian pound* of rain-water must be obtained from every 20,800 cubic feet of air.

The whole quantity of ammonia contained in the same number of cubic feet will also be returned to the earth in this one pound of rain-water. But if the 20,800 cubic feet of air contain a single grain of ammonia, then ten cubic inches, the quantity usually employed in an analysis, must contain only 0.000000048 of a grain. This extremely small pro-

*1.1lbs. avoirdupois.

portion is absolutely inappreciable by the most delicate and best eudiometer ; it might be classed among the errors of observation, even were its quantity ten thousand times greater. But the detection of ammonia must be much more easy, when a pound of rain-water is examined, for this contains all the gas that was diffused through 20,800 cubic feet of air.

If a pound of rain-water contains only $\frac{1}{4}$th of a grain of ammonia, then a field of 40,000 square feet, must receive annually upwards of 80lbs. of ammonia, or 65lbs. of nitrogen; for, by the observations of *Schubler*, which were formerly alluded to, about 700,000lbs. of rain fall over this surface in four months, and consequently the annual fall must be 2,500,000lbs. This is much more nitrogen than is contained in the form of vegetable albumen and gluten, in 2,650lbs. of wood, 2,800lbs. of hay, or 200 cwt. of beet-root, which are the yearly products of such a field, but it is less than the straw, roots, and grain of corn, which might grow on the same surface, would contain.

Experiments made in this laboratory (Giessen) with the greatest care and exactness, have placed the presence of ammonia in rain-water beyond all doubt. It has hitherto escaped observation, because no person thought of searching for it. All the rain-water employed in this inquiry was collected 600 paces southwest of Giessen, whilst the wind was blowing in the direction of the town. When several hundred pounds of it were distilled in a copper still, and the first two or three pounds evaporated with the addition of a little muriatic acid, a very distinct crystallization of sal-ammoniac was obtained : the crystals had always a brown or yellow color.

Ammonia may likewise be always detected in snow-water. Crystals of sal-ammoniac were obtained by evaporating in a vessel with muriatic acid several pounds of snow, which were gathered from the surface of the ground in March, when the snow had a depth of ten inches. Ammonia was set free from these crystals by the addition of hydrate of lime. The inferior layers of snow, which rested upon the ground, con-

tained a quantity decidedly greater than those which formed the surface.

It is worthy of observation, that the ammonia contained in rain and snow water, possessed an offensive smell of perspiration, and animal excrement,—a fact which leaves no doubt respecting its origin.

Hünefeld has proved, that all the springs in *Greifswalde*, *Wick*, Eldena, and Kostenhagen, contain carbonate and nitrate of ammonia. Ammoniacal salts have been discovered in many mineral springs in *Kissingen* and other places. The ammonia of these salts can only arise from the atmosphere.

Any one may satisfy himself of the presence of ammonia in rain, by simply adding a little sulphuric or muriatic acid to a quantity of rain-water, and evaporating this nearly to dryness in a clean porcelain basin. The ammonia remains in the residue, in combination with the acid employed; and may be detected either by the addition of a little chloride of platinum, or more simply by a little powdered lime, which separates the ammonia, and thus renders its peculiar pungent smell sensible. The sensation which is perceived upon moistening the hand with rain-water, so different from that produced by pure distilled water, and to which the term *softness* is vulgarly applied, is also due to the carbonate of ammonia contained in the former.

The ammonia, which is removed from the atmosphere by rain and other causes, is as constantly replaced by the putrefaction of animal and vegetable matters. A certain portion of that which falls with the rain, evaporates again with the water; but another is, we suppose, taken up by the roots of plants, and, entering into new combinations in the different organs of assimilation, produces albumen, gluten, quinine, morphia, cyanogen, and a number of other compounds containing nitrogen. The chemical characters of ammonia render it capable of entering into such combinations, and of undergoing

numerous transformations. We have now only to consider whether it really is taken up in the form of ammonia by the roots of plants, and in that form applied to their organs to the production of the azotized matters contained in them. This question is susceptible of easy solution, by well-known facts.

In the year 1834, I was engaged with Dr. Wilbrand, Professor of Botany in the University of Giessen, in an investigation respecting the quantity of sugar contained in different varieties of maple-trees, which grew upon soils which were not manured. We obtained crystallized sugars from all, by simply evaporating their juices, without the addition of any foreign substances; and we unexpectedly made the observation, that a great quantity of ammonia was emitted from this juice, when mixed with lime, and also from the sugar itself during its refinement. The vessels, which hung upon the trees in order to collect the juice, were watched with great attention, on account of the suspicion that some evil-disposed persons had introduced urine into them, but still a large quantity of ammonia was again found in the form of neutral salts. The juice had no color, and had no reaction on that of vegetables. Similar observations were made upon the juice of the birch-tree; the specimens subjected to experiment were taken from a wood, several miles distant from any house, and yet the clarified juice, evaporated with lime, emitted a strong odor of ammonia.

In the manufactories of beet-root sugar, many thousand cubic feet of juice are daily purified with lime, in order to free it from vegetable albumen and gluten, and it is afterwards evaporated for crystallization. Every person, who has entered such a manufactory, must have been astonished at the great quantity of ammonia which is volatilized along with the steam. This ammonia must be contained in the form of an ammoniacal salt, because the neutral juice possesses the same characters as the solution of such a salt in water; it acquires, namely, an acid reaction during evaporation, in

consequence of the neutral salt being converted by loss of ammonia into an acid salt. The free acid which is thus formed is a source of loss to the manufacturers of sugar from beet-root, by changing a part of the sugar into uncrystallizable grape sugar and syrup.

The products of the distillation of flowers, herbs, and roots, with water, and all extracts of plants made for medical purposes, contain ammonia. The unripe, transparent, gelatinous pulp of the almond and peach emit much ammonia when treated with alkalies,—*(Robiquet.)* The juice of the fresh tobacco leaf contains ammoniacal salts. The water which exudes from a cut vine, when evaporated with a few drops of muriatic acid, also yields a gummy deliquescent mass, which evolves much ammonia on the addition of lime. Ammonia exists in every part of plants, in the roots (beet-root,) in the stem, (of the maple-tree,) and in all blossoms and fruit in an unripe condition.

The juice of the maple and birch contain both sugar and ammonia, and, therefore, afford all the conditions necessary for the formation of the azotized components of the branches, blossoms, and leaves, as well as those which contain no azote or nitrogen. In proportion as the developement of those parts advances, the ammonia diminishes in quantity, and when they are fully formed, the tree yields no more juice."

"Nitrogen is found in lichens, which grow on basaltic rocks. Our fields produce more of it than we have given them as manure, and it exists in all kinds of soils and minerals, which were never in contact with organic substances. The nitrogen in these cases could only have been extracted from the atmosphere.

We find this nitrogen in the atmosphere in rain-water and in all kinds of soils, in the form of ammonia, as a product of the decay and putrefaction of preceding generations of animals and vegetables. We find, likewise, that the proportion

of azotized matters in plants is augmented by giving them a large supply of ammonia, conveyed in the form of animal manure.

No conclusion can then have a better foundation than this, that it is the ammonia of the atmospherewhich furnishes nitrogen to plants.

Carbonic acid, water, and ammonia, contain the elements necessary for the support of animals and vegetables. The same substances are the ultimate products of the chemical processes of decay and putrefaction. All the innumerable products of vitality resume after death the original form from which they sprung; and thus death,—the complete dissolution of an existing generation,—becomes the source of life for a new one."

ART. LI.—AN EXAMINATION OF THE TESTIMONY RELATIVE TO THE EFFICACY OF THE HYDRATED PEROXIDE OF IRON AS AN ANTIDOTE TO ARSENIC, WITH DIRECTIONS FOR ITS PREPARATION AND EXHIBITION. By T. Romeyn Beck, M. D.

It is now about six years since the use of the peroxide of iron was introduced to the notice of the public. It has been made the subject of numerous, and for the most part satisfactory, experiments on animals; it has been frequently exhibited to persons poisoned with arsenic, and in many instances with success; it is also a substance very easily prepared, and one that can always be kept on hand, either by the physician or druggist.

These circumstances might be supposed sufficient to establish firmly the character of any antidote, and I do not doubt but that it is thus viewed by those who have from time to time noticed the testimony adduced in its favor. But this has, in many instances, consisted of brief notices of successful cases or experiments, scattered through the selections and summaries of Medical Journals, and hence has possibly not made that impression which a collection of the whole would produce. With a view to promote that desirable object, and at the same time to urge an early exhibition of this substance in all cases of poisoning by arsenic, I have ventured to prepare the following observations. I propose to follow the following order. 1. A notice of the discovery. 2. The results of experiments on animals. 3. The efficacy of its exhibition on man. 4. The mode of its preparation and exhibition.

I. The earliest notice that I have seen of the efficacy of peroxide of iron as an antidote, is contained in a letter addressed to M. Poggendorf, the editor of a German Scientific Journal by Dr. Bunsen, bearing date Gottingen, May 1,

1834.* In the same year Drs. Bunsen and Berthold jointly addressed a communication on the same subject to the Academy of Sciences at Paris.† It had been previously established by the experiments of Renault and others, that the native arsenite of iron (mispickel) is nearly innocuous to animals, and on this fact, the investigations of Drs. Bunsen and Berthold seem to have been founded. They also ascertained that "a solution of arsenious acid is so completely precipitated by pure hydrate of iron recently precipitated and suspended in water, that a current of sulphuretted hydrogen gas passed into the liquor after filteration, and the addition of a small quantity of muriatic acid, does not indicate the presence of the smallest quantity of arsenious acid." Again, if a few drops of ammonia be added to the peroxide, and it be digested in a gentle heat, with arsenious acid, reduced to fine powder, a sub-perarsenite of iron is formed, which is perfectly insoluble. Encouraged by these results, they proceeded to perform

II. *Experiments on animals.* From four to eight grains of arsenic were given to two young dogs, and the œsophagus was tied to prevent vomiting, and the peroxide was then exhibited. They lived more than a week without manifesting any of the symptoms of poisoning. A quantity equal to four or six drachms of the peroxide was deemed sufficient to transform in the stomach eight or ten grains of arsenious acid into insoluble arsenite. As, however, the hydrated oxide is innocuous, they advise its use in much larger quantity. Rabbits also which are destroyed by very small doses of arsenic, were saved by the antidote.

Orfila and Le Sueur repeated these experiments on animals and generally with favorable results. They found, however, that if the administration of the antidote was delayed beyond half an hour, all the symptoms of poisoning occurred, and

* London and Edinburg Philosophical Magazine, vol. vi. p. 237.

†Lancet, Oct. 18th, 1834, and American Journal Medical Sciences, February, 1835, p. 537.

death was the termination.* M. Bouley, Jun., of Alfort, made an elaborate series of experiments on horses, and which were published in 1835. He ascertained, in the first place, that the peroxide was totally inefficacious in poisoning by arseniate of potash, (Fowler's solution,) and for a manifest reason—the iron cannot overcome the affinity existing between its constituents. But when he gave white arsenic in doses of two ounces and upwards, and followed it by sixty-four ounces of the hydrated oxide, the animals survived. In several instances, the horses thus treated were killed at the end of nine days, and the stomach and intestines bore the marks of the action of the poison, but evidently in a mitigated degree, and sufficient to show that it had been promptly counteracted. In one case, the antidote was delayed twenty-five hours, and the consequence was, the death of the animal twenty-four hours thereafter, and the stomach, intestines and heart bore marks of the violence of the poison.†

MM. Miguel and Soubeiran of Paris were probably the next experimenters. They found that if a large dose of arsenic was given to dogs, and they were allowed to vomit, it produced no effect, and it was therefore necessary to tie the œsophagus. But this in itself is a fatal operation, and the time that the animal could survive required to be ascertained. A dog whose œsophagus was tied, died in seventy-eight hours, but if nine or ten grains of arsenic were given, and the œsophagus then tied, death followed in two or two and a half hours. In their experiments they used the recently prepared peroxide of hydrated iron mixed with water, in the proportion of twelve parts, to one of white arsenic.

In several instances of dogs thus treated, they survived from seventy-eight hours to six days. But if the exhibition of the antidote was delayed, the animals perished, and the

* American Journal of Medical Sciences, vol. xvi. p. 239.

† Annales C'Hygiene, vol. xii. p. 134; American Journal, August, 1835, p. 518.

time of death appeared to be hastened exactly in proportion to the delay.*

Again, Drs. Borelli and Demaria, of Turin, performed experiments also on dogs with even more favorable results. They consider that four and a half parts by weight of the peroxide are required to neutralize one of arsenious acid,†

Dr. Van Specz, of Vienna, had similar success. He gave arsenic both in powder and in solution, and though in the last the symptoms were more violent, yet in all the animals recovered. He even exhibited the rust of iron successfully.‡

Dr. Donald Mackenzie, of Edinburgh, has related a number of successful experiments on dogs, with arsenic in the solid form, followed by the antidote in the proportion of from twelve to thirty parts. They were killed, either on the first, third, or sixth day after, and the stomach and intestines were found but slightly reddened.§

Lastly I may mention the result obtained by a committee of the Academy of Medicine at Paris, in which not only the hydrated peroxide was found efficient on dogs, but also the common subcarbonate of iron largely suspended in water, four ounces in twenty-four of water. The committee advise that at least half an ounce of peroxide should be taken for each grain of arsenious acid supposed to remain in the stomach.‖

To all this mass of favorable testimony, there can only be opposed the unfavorable results obtained by Mr. Brett and Mr. Orton, (*London Medical Gazette*, vol. xv. p. 220, *Lancet*, November 8, 1834.) But it must be remembered that these investigations were made at an early period of the inquiry; and I may further adopt the remarks of Dr. Maclagan,

* British and Foreign Medical Review, vol. i. p. 594.

† British and Foreign Medical Review, vol. i. p. 595.

‡ American Journ. Med. Sci., February, 1838, p. 519.

§ Lancet, April 4, 1840. American Journal Medical Science, August, 1840, p. 497.

‖ American Journal Med. Sci., February, 1838, p. 519.

of Edinburgh, concerning them. "With respect to the former it may be observed, that he appears uniformly to have used too small quantities of the oxide, and the experiments of the latter hardly seem to have been made with sufficient care, as appears in one instance, at least, from his having injected both poison and antidote into the lungs, instead of the stomach of the rabbit."*

III. *Its Efficacy as an Antidote on Man.* In referring to these, I must be brief, indicating merely the leading points worthy of notice.

1. The first case on record is probably that of M. Leger. A child eighteen months old, drank a solution of fly poison, (probably a variable combination of black oxide of arsenic and oxide of cobalt,) and was immediately seized with symptoms of violent colic. The accident was soon discovered, and the hydrated peroxide was instantly given. Its effects were completely successful within a few hours. *American Journal of the Medical Sciences*, vol. xvi. p. 239.

2. M. Geoffroy, of Paris, gave it in twenty minutes after arsenic, stirred about in water, had been swallowed by a man aged 36. Four or five pints of water, charged with it, were given in a quarter of an hour. Vomiting ensued; but the patient suffered none of the ordinary symptoms of arsenic. He had taken a drachm and a half of arsenic. The next morning he was well. *British and Foreign Medical Review*, vol. i. p. 572. *American Journ. Med. Sci.*, February, 1836, p. 501.

3. Drs. Bineau and Majesté of Saumur, in France, related

* *On the action of the Hydrated Sesquioxide of Iron on Arsenic*, by Douglass Maclagan, M. D., Lecturer on Materia Medica. *Edinburg Medical and Surgical Sournal*, volume liv. page 106. This is a valuable paper in reference to the chemical action of these substances on each other. I have only space to notice the conclusion to which he arrives, and which is, that "the hydrated oxide of iron is a real chemical antidote to arsenious acid, and that when it removes arsenic from solution and soluble combinations, it acts by chemically uniting with it." The large quantities which have been found necessary, are required, not to protect the stomach mechanically, but to render the poison chemically inert.

five cases that occurred in 1835. As many little girls aged from five to nine years, on leaving school, ate part of a cake containing one-fifth of its weight of white arsenic which had been prepared to kill rats. They all were affected violently with the early symptoms of poisoning, and were not seen until two hours or more after the accident, yet all recovered by the free use of the antidote. *B. and F. Medical Review*, volume i. p. 573.

4. Dr. Buzorini relates in *La Lancette Francais*, November 17, 1835, two cases successfully treated. *Amer. Journ.* Aug. 1836, p. 504.

5. Dr. Clinton of New York, in the United States, *Medical and Surgical Journal*, vol. iii. p. 54, also relates a successful case.

6. Mr. Robson, of Warrington, adminfstered with success, first, the subcarbonate of iron, in doses of six drachms, two hours after the poison had been taken, and afterwards the prepared oxide. Nearly three drachms of arsenic had been swallowed. *American Journal of Medical Science*, May, 1837, p. 222.

7. Dr. Thomas, of Baltimore, in a case where twenty grains of arsenic in powder had been given, gave the peroxide with success. *Amer. Med. Intel.*, vol. ii. p. 117.

8. Mr. Macdonald—a successful case in *New York Journ. of Medicine and Surgery*, vol. ii. p. 205.

9. Dr. Gerhard—a successful case in the *Philadelphia Medical Examiner*, vol. iii. p. 250.

10. Drs. Smiley and Wallace in the *Philadelphia Medical Examiner*, vol. iii. p. 679, out of a family of eight persons poisoned by a pudding of Indian meal, prepared for rats, death followed in two cases in seven and nine hours. They could not retain the antidote, but immediately rejected it. The symptoms of all the others were immediately mitigated by its use, and they all recovered.

11. Dr. Murray, of India, successful. *American Journ. Med. Sci.*, Feb., 1839, p. 503, from the *Calcutta Medical Journ.* Dec., 1837.

12. Mr. Deville, of Paris, successful. *Amer. Journ. Med. Sci.*, May, 1839, p. 243.

13. Dr. Puchelt, Jun., seven cases of recovery. *Edinburgh Med. and Surg. Journ.*, vol. liv. p. 263.

It would not be difficult to add considerably to this list. But I have adduced enough to warrant a belief in the efficacy of the antidote. I trust, however, that none of my readers will be led to suppose, that in cases of poisoning by arsenic, they are to depend *solely* on it. Vomiting should be promoted as early as possible, and indeed every mode now in use for the speedy evacuation of the poison. The antidote will find sufficient to operate on what still remains and cannot be removed.

IV. *The Mode of Preparation and Exhibition.* Lassaigne had recommended the following process. Take iron turnings, pour on them four times their weight of the nitric acid of commerce gradually, so as to avoid too rapid an action. A portion of the nitric acid will yield its oxygen to the iron, and change it to a peroxide, which unites with the undecomposed nitric acid, and forms pernitrate of iron. As soon as the action of the nitrous vapor has ceased, add ten or twelve parts of water to dissolve the pernitrate and to precipitate the undissolved turnings. Decant and filter the solution, and add aqua ammonia, until litmus paper becomes blue. A yellowish brown precipitate is formed, which is the hydrate, and which should be washed with boiling water, to free it from the remains of the acid.

Drs. Bunsen and Berthold, however, prefer that preparation obtained by taking a pure solution of the sub-sulphate of iron, increasing its dose of oxygen by heating it with nitric acid, and then pouring into the solution an excess of caustic ammonia. The hydrated oxide is now obtained by decantation. They advise that the nitric acid be added in small portions at a time, otherwise a quantity of the neutral sulphate of the sesquioxide is separated in the form of a yellow powder, which is but slightly soluble. They also insist on the danger of using any other alkali than ammonia.

The Edinburgh college has introduced it into its pharmacopœia, with nearly identical directions, which I copy from Dr. Maclagan's paper, already referred to. "Dissolve sulphate of iron in water, with a little sulphuric acid, adding nitric acid by degrees till it is thus fully oxygenated, and then precipitating the hydrated sesquioxide from this solution by an excess of ammonia. The product thus obtained is of a deep reddish brown." It should be carefully washed, to remove the ammonia; but this can hardly be completely affected without the application of heat; and I apprehend that this last is not to be recommended.

The dry hydrated oxide is inert. It is therefore necessary to keep the antidote, when prepared, under water. It may thus be preserved uninjured in its qualities for a length of time. Professor Fisher, of Maryland, has shown this conclusively in an elaborate paper in the twelfth volume of the *American Journal of Pharmacy*. "In the moist state, it is in the finest possible state of division, and hence best adapted as an antidote."

It is not necessary therefore to have it *freshly prepared* for every case, and the practitioner has only to keep a quantity on hand in closely stopped bottles, remembering to shake it well before administration.

As to the quantity necessary to be given, I will again quote Dr. Maclagan. "As far as chemical evidence goes, at least twelve parts of oxide, prepared by ammonia, and moist, are required for each part of arsenic, and this same proportion has been indicated by several of the French experimentalists as being required to insure its antidotal effects."

But it may be said that in some instances we cannot ascertain how much arsenic has been taken, and the inquiry may be renewed, how are we then to act. To this, I reply, by recommending that to an adult, a tablespoonful, and for children a desert spoonful, should be given every five or ten minutes until relief from the urgent symptoms is obtained.

ALBANY, May 19, 1841.

Amer. Journ. Med. Sci.

ART. LII.—"AN ACCOUNT OF SOME RECENT IMPROVEMENTS IN PHOTOGRAPHY. By H. F. Talbot, Esq. F. R. S."

The author had originally intended, in giving an account of his recent experiments in photography, to have entered into numerous details with respect to the phenomena observed,—but finding that to follow out his plan would occupy considerable time, he has thought that it would be best to put the Society, in the first place, in possession of the principal facts, and by so doing perhaps invite new observers into the field during the present favorable season for making experiments. He has, therefore, confined himself at present to a description of the improved Photographic method, to which he has given the name of *Calotype*, and reserves for another occasion all remarks on the theory of the process.

The following is the method of obtaining the Calotype pictures.

Preparation of the paper.—Take a sheet of the best writing paper, having a smooth surface and a close and even texture.

The water mark, if any, should be cut off lest it should injure the appearance of the picture. Dissolve one hundred grains of crystallized nitrate of silver in six ounces of distilled water. Wash the paper with this solution, with a soft brush, on one side, and put a mark on that side whereby to know it again. Dry the paper cautiously at a distant fire, or else let it dry spontaneously in a dark room. When dry, or nearly so, dip it into a solution of iodide of potassium, containing five hundred grains of that salt dissolved in one pint of water, and let it stay two or three minutes in this solution. Then dip it into a vessel of water, dry it lightly with blotting paper, and finish drying it at a fire which will not injure it even if held pretty near; or else it may be left to dry spontaneously.

All this is best done in the evening by candle light. The paper so far prepared, the author calls *iodized* paper, because it has a uniform pale yellow coating of iodide of silver. It is scarcely sensitive to light, but nevertheless it ought to be kept in a portfolio drawer until wanted for use. It may be kept for any length of time without spoiling or undergoing any change if protected from the light. This is the first part of the preparation of calotype paper, and may be performed at any time. The remaining part is best deferred until shortly before the paper is wanted for use. When that time is arrived, take a sheet of the iodized paper and wash it with a liquid prepared in the following manner:—

Dissolve one hundred grains of crystallized nitrate of silver in two ounces of distilled water, add to this solution one sixth of its volume of strong acetic acid. Let this mixture be called A.

Make a saturated solution of crystallized gallic acid in cold distilled water. The quantity dissolved is very small. Call this solution B.

When a sheet of paper is wanted for use, mix together the liquids A and B in equal volumes, but only mix a small quantity of them at a time, because the mixture does not keep long without spoiling. I shall call this mixture the *gallo-nitrate of silver.*

Then take a sheet of *iodized paper* and wash it over with this *gallo-nitrate of silver* with a soft brush, taking care to wash it on the side which has been previously marked. This operation should be performed by candle light. Let the paper rest half a minute, and then dip it into water. Then dry it lightly with blotting paper, and finally dry it cautiously at a fire, holding it a considerable distance therefrom. When dry, the paper is fit for use. The author has named the paper thus prepared *calotype paper*, on account of its great utility in obtaining the pictures of objects with the camera obscura. If this paper be kept in a press it will often retain its qualities in perfection for three months or more, being ready for use at any moment; but this is not uniformly the

case, and the author therefore recommends that it should be used in a few hours after it has been prepared. If it is used immediately, the last drying may be dispensed with, and the paper may be used moist. Instead of employing a solution of crystallized gallic acid for the liquid B, the tincture of galls, diluted with water, may be used, but he does not think the results are altogether so satisfactory.

Use of the paper.—The *calotype paper* is sensitive to light in an extraordinary degree, which transcends a hundred times, or more, that of any kind of photographic paper hitherto described. This may be made manifest by the following experiment:—Take a piece of this paper, and having covered half of it, expose the other half to day light for the space of *one second*, in dark cloudy weather in winter. This brief moment suffices to produce a strong impression upon the paper. But the impression is latent and invisible, and its existence would not be suspected by one who was not forewarned of it by previous experiments.

The method of causing the impression to become visible is extremely simple. It consists in washing the paper once more with the *gallo-nitrate of silver*, prepared in the way before described, and then warming it gently before the fire. In a few seconds the part of the paper upon which the light has acted begins to darken, and finally grows entirely black, while the other part of the paper retains its whiteness. Even a weaker impression than this may be *brought out* by repeating the wash of gallo-nitrate of silver, and again warming the paper. On the other hand, a strong impression does not require the warming of the paper, for a wash of the gallo-nitrate suffices to make it visible, without heat, in the course of a minute or two.

A very remarkable proof of the sensitiveness of the *calotype paper* is afforded by the fact stated by the author, that it will take an impression from simple moonlight not concentrated by a lens. If a leaf is laid upon a sheet of the paper, an image may be obtained in this way in from a quarter to half an hour.

This paper being possessed of so high a degree of sensitiveness is, therefore, well suited to receive images in the camera obscura. If the aperture of the object lens is one inch, and the focal length fifteen inches, the author finds that *one minute* is amply sufficient, in summer, to impress a strong image upon the paper of any building upon which the sun is shining. When the aperture amounts to one-third of the focal length, and the object is very white,—as a plaster bust, &c.—it appears to him that *one second* is sufficient to obtain a pretty good image of it.

The images thus received upon the calotype paper are, for the most part, invisible impressions. They may be made visible by the process already related, namely, by washing them with the gallo-nitrate of silver and then warming the paper. When the paper is quite blank, as is generally the case, it is a curious and beautiful phenomenon to see the spontaneous commencement of the picture, first tracing out the stronger outlines, and then gradually filling up all the numerous and complicated details. The artist should watch the picture as it develops itself, and when, in his judgment, it has attained the greatest degree of strength and clearness, he should stop further progress by washing it with the fixing liquid.

The fixing process.—To fix the picture, it should be first washed with water, then lightly dried with blotting paper, and then washed with a solution of *bromide of potassium*, containing one hundred grains of that salt dissolved in eight or ten ounces of water. After a minute or two it should be again dipped in water, and finally dried. The picture is in this manner very strongly fixed, and with this great advantage, that it remains transparent, and that therefore there is no difficulty in obtaining a copy from it. The calotype picture is a *negative* one, in which the lights of nature are represented by shades; but the copies are *positive*, having the lights conformable to nature. They also represent the objects in their natural position with respect to right and left. The copies may be made upon calotype paper in a very short

time, the invisible impressions being *brought out* in the way already described. But the author prefers to make the copies upon photographic paper prepared in the way which he originally described in a memoir read to the Royal Society, in February, 1839, and which is made by washing the best writing paper, *first*, with a weak solution of common salt, and *next*, with a solution of nitrate of silver. Although it takes a much longer time to obtain a copy upon this paper, yet, when obtained, the tints appear more harmonious and pleasing to the eye; it requires in general from three to thirty minutes of sunshine, according to circumstances, to obtain a good copy on this sort of photographic paper. The copy should be washed and dried, and the fixing process (which may be deferred to a subsequent day) is the same as that already mentioned.

The copies made by placing the picture upon the photographic paper, with a board below and a sheet of glass above, and pressing the papers into close contact by means of screws, or otherwise.

After a calotype picture has furnished several copies, it sometimes grows faint, and no more good copies can then be made from it. But these pictures possess the beautiful and extraordinary property of being susceptible of revival. In order to revive them and restore their original appearance, it is only necessary to wash them again by candle light with gallo-nitrate of silver, and warm them: this causes all the shades of the picture to darken greatly, while the white parts remain unaffected. The shaded parts of the paper thus acquire an opacity, which gives a renewed spirit and life to the copies of which a second series may now be taken, extending often to a very considerable number. In reviving the picture it sometimes happens that various details make their appearance which had not before been seen, having been latent all the time, yet nevertheless not destroyed by their long exposure to sunshine.

The author terminates these few observations by stating a few experiments calculated to render the mode of action of the sensitive paper more familiar, viz:—

1st. Wash a piece of the *iodized paper* with the gallo-nitrate; expose it to daylight for a second or two, and then withdraw it. The paper will soon begin to darken spontaneously, and will grow quite black.

2d. The same as before, but let the paper be warmed. The blackening will be more rapid in consequence of the warmth.

3d. Put a large drop of the gallo-nitrate on one part of the paper, and moisten another part of it more sparingly, then leave it exposed to a very faint daylight; it will be found that the lesser quantity produces the greater effect in darkening the paper, and in general it will be seen that the most rapid darkening takes place at the moment when the paper becomes nearly dry; also, if only a portion of the paper is moistened, it will be observed that the edges or boundaries of the moistened part are more acted on by the light than any other part of the surface.

4th. If the paper, after being moistened with the gallo-nitrate, is washed with water, and dried, a slight exposure to daylight no longer suffices to produce so much discoloration; indeed, it often produces none at all. But by subsequently washing it again with the gallo-nitrate, and warming it, the same degree of discoloration is developed as in the other cases (experiments 1 and 2.) The dry paper appears, therefore, to be equal or superior in sensitiveness to the moist: only with this difference, that it receives a *virtual* instead of an actual impression from the light, which it requires a subsequent process to develope.

ART. LIII.—"NEW MODE OF PREPARATION OF THE DAGUERREOTYPE PLATES, BY WHICH PORTRAITS CAN BE TAKEN IN THE SHORT SPACE OF FROM FIVE TO FIFTEEN SECONDS, ACCORDING TO THE POWER OF LIGHT. Discovered by A. CLAUDET, in the beginning of May, 1841." Communicated by the Marquis of Northampton, President R. S.

"MY improvement," says the author, "consists in using for the preparation of the plates, a combination of chlorine with iodine, in the state of chloride of iodine. I follow the preparation recommended by Daguerre. After having put the plate in the iodine box for a short time, and before it has acquired any appearance of yellow color, I take it out and pass it for about two seconds over the opening of a bottle containing chloride of iodine, and immediately I put it again in the iodine box, where it acquires very soon the yellow color, which shows that the plate is ready to be placed in the camera obscura. I have substituted for the chloride of iodine chloride of bromine, and have found nearly the same result; but I prefer chloride of iodine as producing a better effect, and besides on account of the noxious smell of bromine.

"The result of my preparation is such, that I have operated in ten seconds with the same apparatus which, without any chlorine, required four or five minutes when using only the original preparation of Daguerre: I have obtained an image of clouds in four seconds."

London, Edinburgh, and Dublin Philosophical Journal.

ART. LIV.—ON THE SPONTANEOUS EVOLUTION OF SULPHURETTED HYDROGEN IN THE WATERS OF THE WESTERN COAST OF AFRICA AND ELSEWHERE.

In the course of a lecture on this subject, delivered at the Royal Institution, by Professor Daniell, he observed, that it was curious that the impregnation of the waters of Western Africa with this deleterious gas had so long escaped attention. In water seaward forty miles its presence can be detected; and it exists in considerable quantity in the Volta, in Lopez Bay, in the Grand Bonny, &c.; it spreads over an area of 40,000 square miles, from about 8° north to 8° south latitude. The origin of this vast accumulation of sulphuretted hydrogen, Mr. Daniell attributes, not to volcanic action, not to the decomposition of pyrites, nor to the process of the decay of animal matter, but to the action and reaction of the vegetable matter carried down by the tropical rivers, and the sulphates always more or less present in sea-water. This, moreover, he has proved by experiment. Last winter he placed some fallen leaves in a jar of new river-water; also a similar proportion in a second jar, with three ounces of salt, and in a third, with a like quantity of the sulphate of soda—all closely stopped, and a card-board, with acetate of lead, over each. After having been kept three months in a warm closet he examined them. The first emitted the common smell of decayed leaves; the second that of a pleasant conserve; but the third, no words could convey the stinking odor, nauseous beyond all description. This of itself was sufficient to establish the generation of sulphuretted hydrogen; but further, the usual blackening of the lead of the card-board in this jar only, left no doubt on the matter. Whenever, then, sea-water holding sulphates in solution mixes with fresh water and vegetable matter, this gas must be produced, and its effects on animal life are well known. It is a record in Italy, as well

as in Essex, that where the sea has been prevented flooding the mashes, that locality, previously very sickly, had become perfectly salubrious. To sulphuretted hydrogen, therefore, Mr. Daniell ascribes the dreaded malaria, as also the deadly stinking miasma of Africa, producing languor, nausea, disgust, and death. The jungle-fever of India, also, he thinks attributable to its presence. The soil abounds with sulphates of magnesia and soda ; must not, therefore, quantities of sulphuretted hydrogen be generated in the jungle-swamps? Besides the direful consequences to the health of man visiting the deadly shores of Africa, this sulphuretted hydrogen does him great injury in a commercial point of view. The copper-sheathing of vessels is rapidly destroyed. Mr. Daniell exhibited a sheet taken from the Bonetta in August 1840, on her return from the African station. Although new not many months before, it was eaten into holes, with a deposit on the one side of the protochloride of copper, and of the black sulphuret of copper on the other. A plate exhibited, taken from the Royal George, was in a good state in comparison with it. The latter had been acted on for sixty years by sea-water, but, be it remembered, by sea-water alone, not impregnated with sulphuretted hydrogen. On it there was no trace of a sulphuret. These, then, were the two principal and important points illustrated by Mr. Daniell; and the question put by him and answered in the affirmative, was, Can science indicate a remedy for these evils? For the former, fumigation with chlorine. Chlorine and sulphuretted hydrogen cannot co-exist. Chemical action instantly takes place ; sulphur is thrown down, hydrochloric acid formed, and malaria and miasma nowhere ; the destroyer destroyed. For the latter, the destructive agent is not decomposed, but its action is directed to a less costly material. Copper is to be protected by zinc, for which sulphuretted hydrogen has the stronger affinity ; and so long as the latter metal is present, the former is free from the attack of the gas in solution. This, it will be readily seen, is Sir H. Davy's principle, which involved the use of zinc or iron ; but in the

case of sulphuretted hydrogen, zinc and not iron must be employed. Mr. Daniell regretted that Davy's zinc-protectors had been so soon abandoned, and only because the copper, not acted upon by the muriatic acid, became a nucleus for earthy, vegetable, and animal matter, and the ship's bottom was in consequence fouled, as it is termed. The remedy for this, he said, was most simple. Let the protectors be so arranged that contact may be broken and renewed at will. The zincs and copper separated for a short time, the earth deposits would soon be removed. In consequence of Mr. Daniell's report to the Admiralty, chlorine has been furnished the Niger Expedition, and no ship hereafter will proceed to the African station without that purifier in store, nor without zinc-protectors for her copper. It is to be hoped that all ship-owners will follow the example of the Admiralty Board in this respect.—*Literary Gazette*, No. 1272.

Additional evidence of the active agency of Salt Water, when in contact with decaying Vegetable Matter, in generating Miasma, in a hot climate, contained in a letter from Professor Daniell to the Editor of "The Friend of Africa."

My Dear Sir,—The evidence of the worst cases of malaria being connected with the decomposition of the sulphates in sea-water increases upon me every day, and I have now the pleasure to send you an abstract of a paper, which you will find at length in the 29th volume of the Annales de Chimie, p. 225, by Signor Gaetano Giorgini, which offers the strongest possible confirmation of my opinion. I trust that it may tend to give confidence to the African expedition; for if we rightly know the cause of the pestiferous exhalations upon the coast, the prevention of ill effects is obvious and easy:—Steam through the salt-waters as fast as possible, and while obliged to be on them make a plentiful use of chlorine fumigation, which instantly decomposes the sulphuretted hydrogen.—I am, &c.

J. F. Daniell.

Captain Washington, R. N.

"The observation of Signor Giorgini has been drawn to the state of tbe atmosphere in the neighborhood of certain marshes on the borders of the Mediterranean; and by reference to historical data, and various documents, he has proved the great importance which attaches to the circumstance of their being at times in communication with the sea, so as to have a mixture formed between their waters and that of the sea. Both ancient and modern authors have announced the fatal effects produced in the neighborhood of marshes by such mixture, and a local belief of the same is very common and strong.

"On the south of the Ligurian Apennines, is a marshy shore, bounded on the west for twelve miles by the Mediterranean, on the south by the river Serchio, and on the north by the river Frigido, a torrent commencing at the foot of the Apennines in the state of Massa di Carrara, running three or four miles over the land, and then falling into the sea. The plain is from two to four miles wide, and is traversed by a few short torrents or streams; among these are the rivers Camajore and Pietra Santa, which divide the plain into three separate basins. The rain and spring waters which flow into the three basins mentioned, are slowly discharged into the sea by natural or artificial canals, penetrating the sand-bank, which exist on the sea side.

"The level of these stagnant waters is between that of high and low water in the neighboring sea, there being but little difference between these two points in this part of the Mediterranean. In this state of things, formerly, when the waters of the sea arose from any circumstance (unless the waters of the marshes were very high,) they used to return up the ditches, fill the basins, and inundate the country to the foot of the mountains; and with a north west wind the waves used to penetrate with force to the interior. The mixture of fresh and salt water thus formed, and which in summer was rarely changed, became corrupt, and spread infection over the neighborhood of the most destructive kind.

"In this way the effects of the malaria were reproduced

annually in the neighboring country with all their peculiar horrors: the population, though small, presented feeble infants and diseased men, old age being unknown there. All attempts to avoid the scourge, by living on the hills, or in the interior, and frequenting the plains when the business of cultivation essentially required it, were vain; they fell victims to the extensive influence, and such being the effects upon the inhabitants of the country, much more rapidly did a stranger suffer from the deleterious atmosphere; one single night in the months of August and September causing inevitable death to the incautious traveller who should stay so long in this infested country.

"Such was the state of things till 1741. Previous to that time Gemignano Rondelli, Eustachio Manfredi, and Bernardino Zendrini had successively insisted upon the necessity of excluding the sea from these marshes; and in 1740-41 a sluice with folding doors, competent to give emission to the waters of the marsh, but prevent the sea from entering, was constructed at the mouth of the Burlamacca. The most complete and unexpected success immediately followed upon, and has continued with this work. The year after its completion there were no appearances of the terrible maladies which previously appeared every year. The inhabitants soon recovered health, and the land being very fertile, the population rapidly increased, and is increasing at this moment. Viareggio has become a considerable town; and so completely has all suspicion of its insalubrity disappeared, that the first families of the city of Lucca have for years built their summer seats there. Notwithstanding the success of the precautions taken at this part of the coast, the neighboring parts were long left a prey to the destroying influence of the mixed marsh-waters; and the inhabitants around the basins at Motrone and Perotto were not considered until the year 1804. In the years 1809, 1810, 1811, similar means were taken, with the best effects, to the inhabitants of Montignoso and the vicinity; and in 1812 a sluice was constructed on the Cinquale, which perfected the arrangements in this part, and made a large por-

tion of the country equally healthy with Viareggio. To complete the arrangement, it was now only required to guard the ditches of Montrone and Tonfalo with sluices; the former was finished in 1819, and the latter in 1821. Since that time the diseases of malaria have ceased so entirely at all points, that no other dangers are now incurred regarding the insalubrity of the atmosphere than such as may arise from neglect of these sluices, which the inhabitants of the country should regard as their palladium.—*Friend of Africa.*—No. 3.

Edinburgh Philos. Journ.

MISCELLANY.

Preparation of Urea.—The usual method of preparing urea, by precipitating it from urine by means of nitric acid, is attended with great expense of time and material. Professor Liebig has recently published the following new and easy method:

Twenty-eight parts of perfectly dried ferrocyanate of potash are mixed with fourteen parts of the black oxide of manganese, both finely powdered, the mixture heated on a smooth iron plate (not in a crucible,) over a coal fire to incipient redness, stirring frequently. The mass on cooling is washed out with cold water, and the liquid mixed with twenty and a half parts of dry sulphate of ammonia. It is advantageous to place aside the first strong ley obtained, and to dissolve the sulphate of ammonia at the common temperature, in the last water, and to add this to the first concentrated solution. Usually a strong precipitate of sulphate of potash is immediately formed, from which the liquid is separated by decantation; it is then evaporated in a water bath, or on some warm place, boiling being avoided, and the liquid poured off as long as it is possible from the deposite of sulphate of potash. It is then evaporated to dryness and treated with boiling alcohol of 80 to 90 per cent., which dissolves the urea, while the sulphate salts remain undissolved. In this manner four ounces of perfectly colorless and beautifully crystallized urea may be obtained from a pound of the ferrocyanate of potash. It frequently happens that the solution containing the sulphate of potash and urea is colored yellow by ferrocyanide of ammonium, or potassium, which dissolves in the alcohol and gives to the crystals of urea a yellowish color; it may easily be separated by the addition of a solution of copperas; after the separation of the prussian blue, carbonate of ammonia is added to the liquid, which decomposes the excess of iron salt, and the liquid becomes clear and colorless, and may be evaporated and treated as above.—August No. of *London, Edinburgh, and Dublin Philosophical Magazine, from Ann. de Chem. and Pharm.* vol. xxxviii. part 1.

Preparation of Azotic Gas. By M. Pelouze.—M. A. Rose has observed that monohydrated sulphuric acid combines directly with nitric oxide,

and absorbs very considerable quantities of it. Sulphate of ammonia being heated in this compound to about 322° Fahr., pure azotic gas, perfectly unmixed with nitrous or nitric oxide, was obtained. This experiment was varied by passing nitric oxide gas into concentrated sulphuric acid, mixed with sulphate of ammonia, and heated from about 300° Fahr. to 392°. The nitric oxide was decomposed as in the preceding experiment, and pure azotic gas was obtained; it is mixed with nitric oxide only when the disengagement is too rapid. M. Pelouze is of opinion that this method of preparing azotic gas may be advantageously employed.

Journ. de Pharm.

Concentration of Nitric Acid, by means of Sulphuric Acid. By M. Pelouze.—It is stated in different chemical treatises, that concentrated sulphuric acid, decomposes nitric acid into water, with which it combines, and hyponitrous acid. M. Pelouze doubted the accuracy of this statement, and was convinced that it was erroneous, by observing nitric acid distilled from a mixture of nitrate of ammonia, with great excess of sulphuric acid, at 212°.

500 parts of concentrated sulphuric acid were mixed with 100 of nitric acid of specific gravity 1.448; the mixture was slowly distilled and yielded 88 parts of nitric acid of specific gravity 1.520; this product freed from red vapor by a gentle heat was mixed with six and a half times its weight of concentrated sulphuric acid, unaccompanied by any sensible increase of temperature. The mixture was colorless, and yielded very dense white vapors of nitric acid. When heated to a temperature which never exceeded 302°, and was kept as near as possible to 212°, 82 parts of nitric acid of specific gravity 1.520 were distilled; its density remained 1.520, and its boiling point was from 185° to 188° Fahr.

A third rectification with sulphuric acid effected no change either in the properties, density or color of the nitric acid.—*Journ. de Pharm.* t. xxvij. p. 275,) per *London, Edinburgh, and Dublin Philosoph. Mag.*

On the Microscopic Characters of healthy Milk.—By Professor Von D'Outrppont, of Wurzburg.—He has recently put to the test some of M. Donné's statements with reference to the characteristics of healthy milk, and has arrived at somewhat different conclusions, though he fully confirms Donné's statements with reference to the difference of the corpuscles in the colostrum and milk.

Professor Von D'Outrepont found that in the greater number of instances the peculiar granular bodies of the colostrum (*corps granuleux*) disappeared on the third day after delivery, and not on the sixth or tenth as stated by Donné. Even in those cases, however, in which they could still be detected on the tenth or twelfth day, the milk produced no injurious effects on the infant; nor did it indeed in some instances in which the milk re-

tained the characters of colostrum so long as a month after delivery. The milk of a female laboring under severe metro-peritonitis presented the characters of true milk, not of colostrum. That likewise from the left breast of a person whose right breast was in a state of suppuration presented all the characters of healthy milk, though pus-globules were mixed with the milk in the other breast. In two instances where the breasts became inflamed without suppurating, the milk continued to present all the characters of the healthy secretion and did not contain any of the granular bodies of the colostrum.

Professor D'Outrepont had the opportunity of examining the milk of a woman who, after having suckled her third child for some months, began to menstruate regularly. During the flow of the menses the child became indisposed to suck and suffered from vomiting, but recovered its health immediately on their cessation. During menstruation the milk possessed all the characters of colostrum, while at other times its apperance was precisely that of healthy milk. The secretion from the breasts of a woman who had never been pregnant, presented all the peculiarities of colostrum; that contained in the breasts of another woman who never suckled her children, though the glands were always full except during pregnancy, differed in no respect from healthy milk.—*British and Foreign Medical Review, from Neue Zeitschrift fur Gebertskunde. Bd.* x. *Heft* i.

On a sedative Lotion in headachs, Congestions, and Cerebral Fevers. By M. Raspail.—Professor Raspail, in a letter to the editor of *l'Experience*, gives the mode of preparing a lotion, the sedative effect of which, he says, is almost instantaneous. It is as follows:

Liquor of ammonia (Qy. the strength?)	100 pts.
Distilled water,	900 "
Purified marine salt,	20 "
Camphor,	2 "

Essence of rose, or some other scent, in the necessary proportion.
The whole dissolved cold.

A piece of linen is to be steeped in this solution and applied over the part of the head that the patient points out as the seat of pain, taking care, if it is on the forehead, to apply a thick bandage over the eyebrows, to prevent any drops of the fluid passing into the eyes.

M. Raspail says he has seen headachs intolerably violent, accompanied by photophobia, and retraction of the globes of the eye, disappear completely, from a quarter to half an hour after the application of one wetted cloth. The linen is to be soaked as often as a new access of pain is threatened, and left on the head until it is necessary to soak it anew. In the numerous trials the author has made with this solution, first on hi-

self, and afterwards on others, he has been struck by two circumstances of interest in connection with organic chemistry and symptomatology. When in a violent attack of cerebral fever, we apply on the principal seat of the inflammation a concentrated solution of marine salt, an evident odor of chlorine is disengaged, the diseased reaction being analogous to the decomposing and deoxygenating action of manganese, in the elimination of chlorine from marine salt, by means of sulphuric acid. Is this sign constant in affections of this class? It is for experience to decide. When, on the contrary, we employ a solution of ammonia, a strongly characterized *hircine* (goatish) odor is manifested. The same odor has been disengaged on the application of hydrochloric acid to the skin. M. Raspail has drawn the attention of the profession to this subject in order that they may employ this formula, and fix their attention on the analysis of the disengaged substances, as they may become characteristic of special affections.

Ibid, from l'Experience. 24 Juillet, 1840.

Remarks on the Tinctura Opii Ammoniata of the Edinburg Pharmacopœia. By J. H. Gilbert, Nottingham. Being a student in the laboratory of the Glasgow Royal Infirmary during the summer of 1839, it was occasionally my duty to dispense the *Tinctura Opii Ammoniata*,—a preparation, the apparently unchemical composition of which led me to suspect, that as far as the opium employed is concerned, it could be of no utility; it being well known that ammonia acts as a precipitant to morphia. It is true that a great excess of that alkali will, in some solutions of the salts of morphia, either prevent its precipitation, or redissolve it when precipitated. In order, therefore, to ascertain the fact in the present instance, I submitted several separate portions of the tincture to examinatioo at Dr. Thompson's laboratory, where also I was a student.

Two ounces were first boiled in a flask with magnesia; the magnesian precipitate collected and boiled with alcohol; the alcoholic solution filtered while hot, and set aside in a warm situation to evaporate slowly: no crystals were deposited, and the residual matter, when tested; was found to contain no morphia.

Four ounces were next treated in a manner varying from the above. The liquid, previous to further treatment, was saturated with dilute acid; for when, as before stated, morphia has been held in solution by an excess of ammonia, I have found that after expelling the greater part of that excess by gentle heat, and then saturating with dilute acid, a salt may be obtained; from the solution of which the morphia may be separated by the usual means. In the present case, however, no morphia was detected.

Having thus failed to detect that principle in the filtered tincture, the dregs of a known quantity were macerated for some time in water acidulated with muriatic acid;—the filtered liquid, after being digested with ani-

mal charcoal, was sufficiently concentrated on a water bath, and set aside when a large quantity of crystals of muriate of morphia was deposited. A part of these were treated with ammonia, and the morphia tested in a separate state with a neutral solution of the perchloride of iron; and part, while in the state of muriate, was tested with iodic acid in the usual manner. As the dregs employed were not exhausted, nor the mother liquor treated with ammonia, an accurate quantitative result could not be obtained; but the amount of muriate of morphia was so great that it could not fall much short of the average produce of such a quantity of opium.

These experiments I had considered as conclusive. But, finding the new Edinburgh Pharmacopœia retained the old formula, and that the remarks made on the tincture by various writers on materia medica and pharmacy seemed to indicate previous experiment, I feared that either too small a quantity had been operated upon, or that some source of error had been overlooked. To obviate any such mistake, several portions, each of twelve ounces, were successively examined; in none, however, was morphia detected. As a check to the processes, several portions also of tincture of opium, (each of which would contain, by estimate, a quantity of opium equivalent to that in twelve ounces of the ammoniated tincture,) were treated in precisely the same modes as the ammoniated tincture had been. In these cases morphia was separated without difficulty; thus proving the efficacy of the processes.

It may be observed, that, before any of the tinctures were boiled with magnesia, the greater part of the ammonia and alcohol in the one, and of alcohol in the other, was expelled by gentle heat on the water-bath; as, in some cases, the alcohol in the liquid would be sufficient to take up the morphia after the decomposition of its salts by magnesia. The loss of ammonia caused no deposition of morphia.

These facts seem to show that, if as I believe is universally admitted, the medicinal effects of opium are attributable chiefly, if not entirely to the morphia which it contains, the opium employed in this tincture might with advantage be omitted.—*Edinburgh Medical and Surg. Journ.*